Aalto University
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ENHANCING COLLABORATION BETWEEN PARTICIPANTS IN A RESEARCH AND DEVELOPMENT CONSORTIUM

Master's Thesis
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ABSTRACT OF THE MASTER´S THESIS

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Due to an accelerated technology change and market globalization, various forms of strategic collaborations have become an increasingly important venue through which organizations strive to gain a competitive advantage. Despite their popularity, not all collaborations are successful and there is a lack of agreement on the factors regarding performance. Thus, the research focus has turned towards management factors and the knowledge gained over the course of a collaboration.

As knowledge gain has become one of the most important motivations to enter strategic collaboration, this study examines the creation of knowledge and learning in a research and development project in Finnish health and wellbeing sector. In more detail, the purpose of the study is to understand the collaboration between individual project members coming from participating companies and research organizations and to form practical implications for the ongoing project and future collaborations alike.

Approach to the research topic was explorative, and the study was executed as a single case study. To gain an in-depth understanding of the case, qualitative research methods were chosen to best suit the data gathering. A total of ten semi-structured interviews were conducted and all premises of participating organizations were visited. In addition, participative observation was carried out in the project related activities. The data was analysed using a constant comparative method.

Based on the results, participating organizations of the project worked mainly independently. The coordination of the project was slack partly due to leadership having changed from being the responsibility of research organizations to that of the companies. Moreover, intellectual property rules were considered to have decreased the openness of their communication. However, participants were motivated to conduct research, hoped it had relevance in the future and weighed the consortium as significant. To enhance the current state of collaboration, interaction between participants should be increased further and knowledge creation activities diversified.

This study contributes to strategic collaboration literature by forming an in-depth understanding of the mechanics and the influencing factors of a collaborative project. As practical contributions, several activities were designed to enhance the collaboration of the on-going project and future collaborations. As the research concentrated on one single case, findings regarding the state of the collaboration cannot directly be generally applied to all collaborative projects and industry sectors. However, as several influencing factors form the base of any collaborative behaviour, the suggested activities might be applicable to a varying extent to diverse forms of collaborative projects.

Keywords:	Publishing language:
R&D consortium, collaboration, knowledge management, learning, knowledge creation, strategic alliance	English

AALTO-YLIOPISTO
Perustieteiden korkeakoulu
Tuotantotalouden koulutusohjelma

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Kiihtyneen teknologiakehityksen ja globalisoituneiden markkinoiden takia eri strategiset yhteistyön muodot ovat lisääntyneet kilpailuedun saamiseksi. Vaikka yhteistyö on lisääntynyt, projektien onnistumisesta on kuitenkin ristiriitaisia tuloksia. Onnistuneen projektin läpiviemiseksi on siirrytty tutkimaan tarkemmin projektin johtamis- ja oppimistekijöitä projektin aikana. Tiedon on koettu olevan yhä tärkeämpi resurssi organisaatioiden kilpailukyvyn säilyttämisessä.

Tämä työ käsittelee tiedon tuottamista ja oppimista organisaatioiden välisessä yhteistyössä tapaustutkimuksena. Valittuna kohteena oli usean tutkimus-organisaation ja yrityksen välinen tutkimus- ja kehitysprojekti terveydenhuollon alalla. Tavoitteena oli tutkia yhteistyöprosessia yksittäisten osallistujien välillä ja luoda tulosten perusteella käytännön ehdotuksia nykyisen ja tulevan projektitoiminnan tueksi.

Tutkimusaihetta lähestyttiin eksploratiivisesti tapaustutkimuksena. Laadullisia tutkimusmenetelmiä käyttäen projektin toiminnasta pyrittiin saamaan laaja-alainen ymmärrys. Empiirinen osa koostui kymmenestä puoli-strukturoidusta haastattelusta sekä havainnoinnista osallistuvien organisaatioiden tiloissa. Lisäksi osallistuvaa havainnointia tehtiin projektiin liittyvissä tapahtumissa. Löydökset analysoitiin jatkuvalla vertailevalla metodilla.

Tulosten perusteella projektin tutkimusta tehtiin itsenäisesti ja eristyksissä. Projektin löyhä koordinointi johtui mahdollisesti projektien vetovastuun siirtymisestä tutkimusorganisaatioilta yritysten vastuulle. Projektin osallistujat olivat kuitenkin motivoituneita ja kokivat projektin tärkeäksi mahdollistajaksi tutkimuksen tekemisessä. Osallistujien välistä vuorovaikutusta lisäämällä ja tiedon luontitapoja monipuolistamalla projektin toimintaa voitaisiin edelleen kehittää.

Tutkimus edistää yhteistoimintakirjallisuutta antamalla paremman ymmärryksen yhteistoiminnallisten projektien toimintamekanismeista ja yhteistyötä parantavista tekijöistä. Löydösten perusteella käytännön kontribuutiona kehitettiin useita aktiviteettiehdotuksia sekä käynnissä olevan että tulevan projektitoiminnan edistämiseksi. Koska tutkimus kohdistui yksittäiseen tapaukseen, löydöksiä ei voida suoraan yleistää kaikkiin yhteistoiminnallisiin projekteihin tai eri toimialoihin. Ehdotetut aktiviteetit saattavat kuitenkin toimia laajemmassa projektitoiminta-kontekstissa, koska universaali yhteistoiminta perustuu monille tutkimuksesta löytyneille tekijöille.

Asiasanat:	Julkaisukieli:
konsortio, yhteistoiminta, tietojohtaminen, tiedon luonti, oppiminen, tutkimus- ja kehitys, strateginen allianssi	englanti

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In Melbourne, 5th of June,

Pauliina Mattila

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ABBREVIATIONS

R&D = Research and Development

PD = Product Development

UI = University-Industry

GUI = Government-University-Industry

SA = Strategic Alliance

NPD = New Product Development

RBV = Resource Based View

SHOK = Strategisen Huippuosaamisen keskittymä

= Strategic Centres for Science, Technology and Innovation

IMO = Intelligent Monitoring for Health and Wellbeing

SalWe = Strategic Centre for Technology, Science and Innovation in Health and Wellbeing

TEKES = Teknologian ja Innovaation Edistämiskeskus

= the Finnish Funding Agency for Technology and Innovation

ADF = Aalto Design Factory

IPR = Intellectual Property Rights

1 INTRODUCTION

"If you think you can go it alone in today's economy, you are highly mistaken."

- Jack Welch, chief executive of General Electric

Due to accelerated technology change and market globalization, various forms of strategic collaborations have become increasingly important avenues through which organizations strive to gain competitive advantage. In this chapter, the background of strategic collaborations, research need and the goals of the study are presented. A Finnish research and development project consisting of private companies and research organizations is investigated as a case study to understand the grass-root level collaboration between individual participants. Additional aim is to derive practical implications for the project and future collaborations. Finally, the structure of the thesis is presented.

1.1 RATIONALE FOR STRATEGIC COLLABORATION

Although strategic collaborations have existed for several decades, since the 1990s, companies and research organizations cooperate more and more across organizational barriers in research and development (R&D) and product development (PD) to gain competitive advantage (Harbison, Pekar and Stasior, 1998 p. 10-11; Chen, 2005). Reasons for the growing number of collaborations are numerous: increasing speed of technology change and its influence on blurring industry boundaries, increased R&D costs and scarce resources and intensifying competition for markets due to globalization (Hagedoorn, 1993 p. 378; Lambe and Spekman, 1997; Harbison, Pekar and Stasior, 1998 p. 11; Kakabadse and Kakabadse, 2000; Campione, 2003). That is, the market and technology change have led organizations to search for competitive advantage through collaboration.

Researchers have found three primary motivations for strategic collaborations: strategic, transaction cost related and learning related (Kale, Singh and Perlmutter, 2000 p. 218). Although all motivations pose an important reason for collaboration, several researchers agree that the key to competitive advantage of an organization is the acquisition, creation, transfer and application of knowledge (Kogut and Zander, 1992; Spender, 1994; Grant, 1996; Rolland and Chauvel, 2000). Moreover, sources of innovation do not reside exclusively inside organizations; instead they are commonly found in the interfaces between firms, universities, research laboratories, suppliers and customers (Inzelt, 2004). Thus, the question is no longer about forming a strategic collaboration or not (Harbison, Pekar and Stasior, 1998). Key topics concern the most appropriate arrangement types, management aspects of strategic collaborations and learning from own and that of others' experience (Ibid. 1998 p. 149).

1.2 SHOKS AS INNOVATION BOOSTERS AND INDUSTRY SAVERS

In this study, a particular form of strategic collaboration, SHOK, is researched. SHOKs, Strategic Centres for Science, Technology and Innovation (in Finnish: Strategisen Huippuosaamisen Keskittymä SHOK) are new public-private partnerships established in Finland for speeding up innovation processes, and their main goal is to "thoroughly renew industrial clusters and to create radically new innovations" (Tekes, 2011).

SHOKs were established on those sectors of business and industry that were considered to best meet the needs of Finnish society in the long term. The main objectives are to create jobs and to grow the national economy. In practice, companies and research organizations work closely according to a jointly defined research agenda and apply new methods for cooperation, co-creation and interaction. The research outcomes are to be launched within five to ten years. (Tekes, 2011)

The particular case of the study is a project in one of the six SHOK clusters, Strategic Centre of Science, Technology and Innovation in Health and Well Being (SalWe). SalWe is a non-profit company of 28 shareholders consisting of research units and universities to private companies and associations. SalWe coordinates two research programmes both aiming at creating scientific know-how and developing new solutions and innovative tools for the health sector. The project under study belongs to one of the programmes, Intelligent Monitoring for Health and Well-being (IMO) as Aalto Design Factory (ADF) is one of the research participants. (SalWe, 2012) Both programmes are further divided into several sub-projects, called as work packages, each of them driven by own research agenda (SalWe, 2010). The work packages are led by companies who are most interested in the research agenda.

The case, one of the work packages in IMO-programme, started in June 2010 and continued till the end of 2013 according to the initial research plan. The aim of the work package is to create and develop new manufacturing technologies to blood sample devices. As the work package aims at a particular scope and is limited to a certain time period, it is referred to as a *project* in the thesis. The work package originally consisted of eight *participating organizations,* three of which were private companies and five research organizations. Two of the companies and one research organization withdrew from the project in the early phase. During the research period documented in this thesis from December 2012 till August 2013, altogether one company and four research organizations participated the work package including Aalto University and namely Aalto Design Factory as the participating unit. Figure 1 illustrates the structure of the SHOK clusters and the linkage to the case under study.

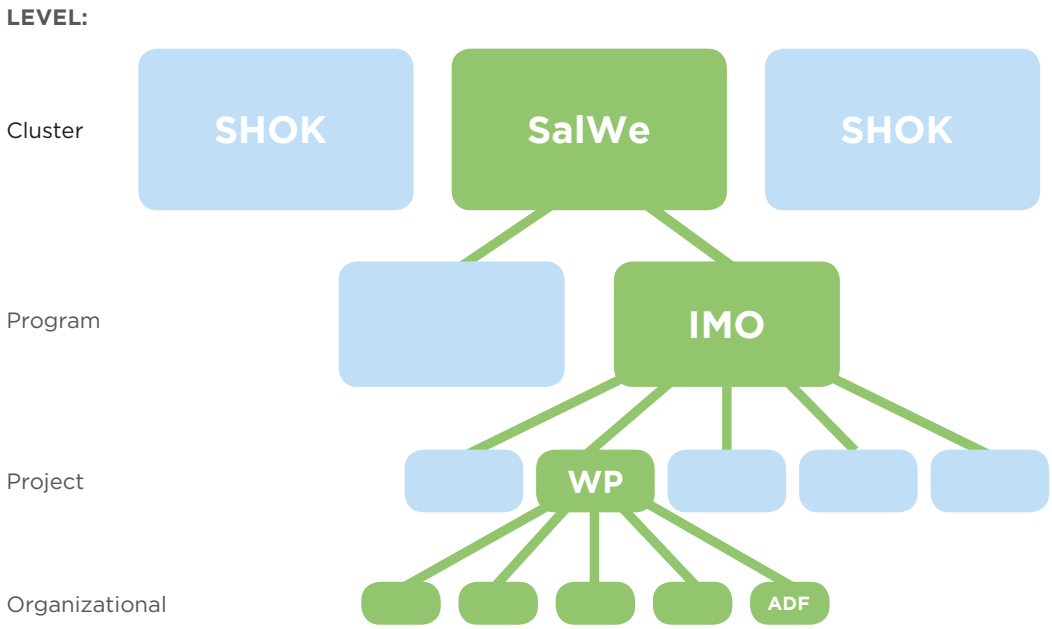

Figure 1: Illustration of the linkages between SHOK clusters, programmes, work packages and organizations.

1.3 AALTO DESIGN FACTORY AND ITS ROLE IN THE IMO-PROGRAMME

As mentioned, Aalto Design Factory (ADF) is one of the participating research organizations in the work package. It has no substance know-how, but a facilitating role in the project. ADF is one of Aalto University's flagship projects, a platform integrating interdisciplinary education, research and industrial collaboration, bringing together university students, researchers, entrepreneurs and industry representatives. (Björklund et al., 2011)

ADF is a combination of a physical space as well as a social and mental environment aiming at supporting interdisciplinary learning and enhancing university-industry collaboration. The environment is open and non-hierarchical enabling collaboration, information sharing and experience exchange across all disciplinary and organizational boundaries. It encourages experimental problem-based learning, promotes hands-on doing and cultivates open climate. The long-term goal is to be the leading actor in transforming the collaboration between university and industry.

As a facilitator of the project, ADF's responsibility is to assist collaborative events and activities, and to apply working methods and tools developed in the ADF context to the project work. Moreover, it brings the combined knowhow of engineering and design to the technology and device development. (SalWe, 2010) Although ADF is administratively one equal participant in the project, it has no substance knowhow on the technology development. In practice, ADF researchers are actively involved in the project activities, acting as organizers and simultaneously observing the project from collaboration perspective. ADF's role in the project is similar to the ADF's goal to be the transformer of university-industry collaboration. Moreover, the role in the project is in

line with the goal of enhancing collaboration across all organizational, hierarchical and disciplinary boundaries.

During the research period reported in this thesis from December 2012 till August 2013 a total of three researchers, one full-time and two part-time, were actively involved in the project.

1.4 RESEARCH NEED IN THE LITERATURE AND THE FUTURE OF SHOKS

ADF's scope in the project is similar to what several scholars in the academic field have identified researching collaboration issues. Moreover, national concern on the usefulness of SHOKS has emerged, which has lead to a search of SHOK specific collaboration success factors.

Although the strategic collaboration literature is vast (Trott, 2008) and considerable research has been dedicated to identifying factors for successful collaborative projects (Barnes, Pashby and Gibbons, 2006 p. 403), researchers pose several open questions to be answered. First, little research has been done on how project organization affects different types of learning in the product development context (Chen, 2005; Provan, Fish and Sydow, 2007). Second, "little work has been done pertaining to how this knowledge could be applied in practice", to produce improvements in collaboration management (Dyer, Kale and Singh, 2001; Barnes, Pashby and Gibbons, 2006 p. 395). Moreover, knowledge integration processes between several parties and their management issues need to be understood for future R&D collaboration management (Liyanage, Greenfield and Don, 1999 p. 391). Indeed, there is no broad evidence of or evaluation on the factors favouring organizational learning and the appropriation of knowledge and competence developed over the course of an R&D collaboration (Ingham and Mothe, 1998, p. 249). The ability to form and manage collaborations more effectively is the key to gain competitive advantage.

Added to the academic discussion, national concern has recently emerged on the advantages of and the initial results on the SHOK clusters (Boxberg, 2013; Grundström, 2013; Hänninen, 2013; Lukkari, 2013). Considerable amount of investment has been put to the programmes and high expectations have been set (Hänninen, 2013), but the preliminary evaluation on SHOKS has stated the contrary (Lähteenmäki-Smith et al., 2013). Instead of applying new methods of collaboration, most of the programmes are formed "in a rather traditional manner avoiding risks and multidisciplinary challenges" (Lähteenmäki-Smith et al. 2011 p. 47). "From the point of view of cooperation and goal achievement this can be seen as a practical solution but the approach is not very future-oriented and innovation-driven" (Ibid. p. 47).

The major concerns are the worth and the added value of SHOK investments. Moreover, the added value has been difficult to articulate (Lukkari, 2013). Collaboration model raises multiple open questions: why would companies open up their strategies to others? What is the rationale for universities to contribute to applied research, which is closer to companies' product development than to scientific research? (Ibid.) Several improvements to the programmes have been suggested, most extreme being phasing

out the concept and transforming it into another type of activity (Lähteenmäki-Smith et al. 2013 p. 334). Nevertheless, SHOK as a collaboration form is new, thus, there is room for improvement and development.

This study forms part of the research work of ADF by being actively involved in the project work but also by scientifically investigating the case through collaboration lense. The following figure 2 illustrates the research gap of the study. As the market change has forced organizations to look for sources of competitive advantage, strategic collaborations have been proven to result in an effective means to gain new knowledge. Literature has been able to identify several success factors of a collaboration performance but the individual level activities remain unknown. Once the understanding of and ability to manage collaborations more effectively increases, participating organizations will gain more competitive advantage (Dyer, Kale and Singh, 2001).

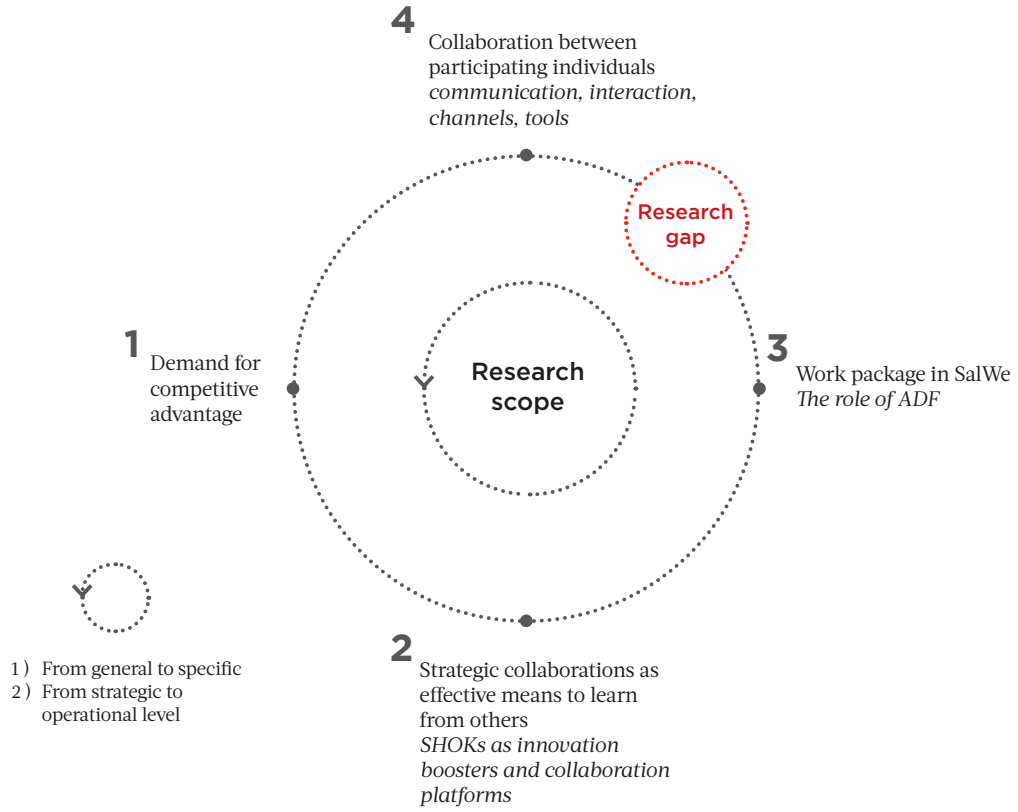

Figure 2: Illustration of the research gap of the study. (adapted from McGrory, 2011; Guseynova, 2013)

1.5 RESEARCH GOALS AND LIMITATIONS

Rising from the three-fold research (figure 3) this thesis aims at understanding how identified factors in the literature are implemented in the project and how they influence the process of R&D collaboration between the project participants. It contributes to understanding on how R&D collaboration works on the micro-level and from those insights derives practical implications for strategic collaboration processes.

In more detail, the goals of this study concern the undergoing project and future collaborations:

During the existence of the case under study:

1. To understand the project context and identify collaboration factors that enhance or decrease the project successfulness.
2. From the insights of the research, the goal is to create several practices and suggestions that would support the collaboration within the work package. These practical implications seize especially the challenges and practices that can be affected.

For the future:

3. As SHOKs as collaboration form are new, to aim at understanding the grass-root level of the process and to give practical implications to future SHOK collaborations.

The first part of the goal seizes especially the project performance and tries to give immediate suggestions that could be implemented during the project existence. The second part of the goal aims at contributing to the SHOK renewal process and links the research work to ADF's long-term goal to act as a change agent in transforming the collaboration across disciplinary and organizational boundaries.

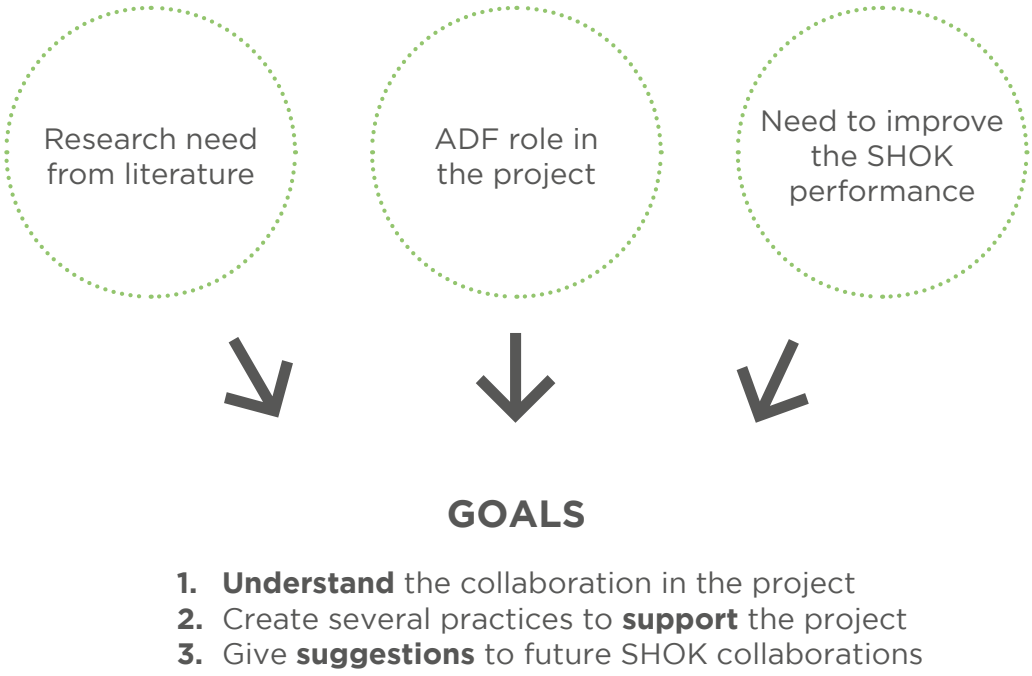

Figure 3: Three-fold research need and the goals of the study.

As this thesis formed part of the research work for ADF and the work package, it has a strong emphasis on the practical activities to enhance the collaboration between project participants. Although the approach to the case is pragmatic, it does not decrease the need for academic argumentation. This study can be identified as

exploratory research, where the interest is to create a solution to a practical problem (Holmström, Ketokivi and Hameri, 2009). The problems to be researched are typically complex and ill-defined (Niiniluoto, 1993 p. 17). Hence, the research goals of this study are fairly open-ended. The study covers the chosen case, namely one R&D project consisting of research organizations and private companies and concerns the individual participants working in the mentioned organizations.

1.6 THESIS STRUCTURE OVERVIEW

The structure of the thesis follows the research process from December 2012 to August 2013 and it has worked as a documenting tool of the research project. This introduction chapter sets the scene for the topic and briefly introduces the case. In the next chapter, relevant academic literature domains are presented. Literature review starts with basic literature streams and definitions of strategic collaborations and continues with relevant research domains such as knowledge transfer and management and organizational learning theories approaching the case from several perspectives. The chapter three introduces the research and data gathering methods and presents the data analysis process. In the next chapter, results of the data are presented and the chapter five provides discussion of the results and several activities to enhance collaboration in the project. Finally, the chapter six concludes the thesis topic and gives recommendations for future research.

1 INTRODUCTION

Background
Goals
Case description

2 THEORETICAL BACKGROUND

Terminology
Strategic collaborations
Success factors
Learning and knowledge management

3 METHODOLOGY

Single case study
Qualitative methods
Data collection and analysis process

4 RESULTS

Characteristic of the collaboration

5 DISCUSSION

Theoretical implications
Practical implications

6 CONCLUSIONS

Evaluation
Future research need

2 THEORETICAL BACKGROUND

"Coming together is a beginning. Keeping together is progress. Working together is success."

- Henry Ford (1863-1947)

In this chapter, the academic background of the study is presented. As published material on strategic collaboration forms is diverse (Vyas, Shelburn and Rogers, 1995), the literature review first addressed general collaboration activity. Thus, several search strings were used, and the collaboration research stream overview is extensive. As for the terms and definitions, this chapter starts with presenting relevant terminology and then continues with an overview of strategic collaboration. In order to understand the micro-level collaboration between individual participants, learning and knowledge management domains were reviewed for more in-depth information.

2.1 LOOKING FOR ENABLERS AFFECTING PROJECT PERFORMANCE

Part of the strategic collaboration literature suggests several success factors on collaboration performance, but those factors remain fairly universal and implicit, hindering the explicitness of the research (Nonaka and Takeuchi 1995 p. 48). Indeed, (Provan, Fish and Sydow, 2007) admit that a high level of ambiguity in terms and definitions exists. Moreover, several scholars note that learning as a motivation to enter a collaboration and knowledge as a significant intangible resource to transfer are essential in collaboration relations and increasingly gaining more attention (Dodgson, 1993; Grant, 1996; Rolland and Chauvel, 2000). In addition, factors favouring learning and knowledge appropriation in the context of R&D partnerships are not yet extensively researched (Ingham and Mothe, 1998). Thus, following the multidisciplinary principle of exploratory research (Holmström, Ketokivi and Hameri, 2009), the topic of the study was approached from various literature angles, and the intention was to find grass-root level enablers that affect the collaboration performance in the project. Indeed, practical information and implications are "likely to emerge by examining networking, organizational learning and managing intellectual capital concepts" (Liyanage, Greenfield and Don, 1999 p. 391).

Based on the need discussed, the literature review consists of theories on **strategic collaborations**, **organizational learning** and **knowledge management**. As the goal of the study is to understand the collaboration process, project performance, success factors and other qualitative aspects are highlighted in the presented review on collaboration literature. Organizational learning and knowledge management theories are discussed especially in the external collaboration setting as intangible resources are said to be the most important for collaboration success (Vuolle, Lönnqvist and Meer, 2009). Indeed, the intersection of organizational learning and knowledge management is knowledge creation, as it can be defined as the capability of an organization to create new knowledge, spread it throughout the organizational levels and express it in products,

services and systems (Nonaka and Takeuchi 1995 p. 5). That is, the combined capability to create knowledge and to facilitate the learning. In addition, strategic collaboration literature is closely related to interdisciplinary team and innovation literature. Links to these literature streams and reasons for excluding them are presented briefly. The contextual framework of this thesis is illustrated in the figure 4.

To conclude, what tie these three approaches together are the same drivers, i.e. changes in the world economy and a shortening innovation time span. Scholars emphasize the importance of all, organizational learning, knowledge management and inter-organizational collaboration, as a source of competitive advantage.

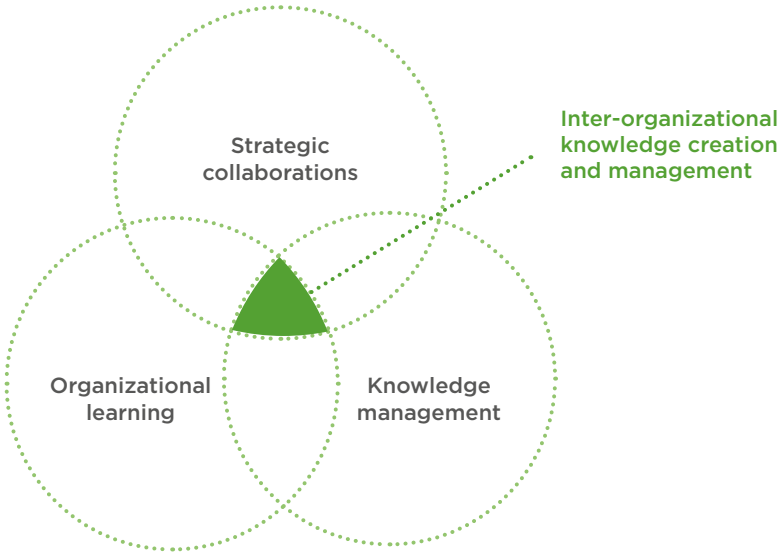

Figure 4: Three main literature areas where the central concept is knowledge creation and its management in inter-organizational context.

2.2 RELATED LITERATURE STREAMS

2.2.1 In search of innovation

Innovation leads to competitive advantage (Nonaka and Takeuchi, 1995; Hardwick, Anderson and Cruickshank, 2013) and key source to innovation is found in the intersection between different bodies of knowledge, crossing the boundaries of the knowledge domains (Von Stamm, 2003 p. 161; Carlile, 2004). Moreover, input especially from external sources is crucial, which leads to interaction and collaboration between various stakeholders (Dodgson, 1993 p. 59; Nonaka and Takeuchi, 1995 p. 6; Powell, Koput and Smith-Doerr, 1996; Von Stamm, 2003 p. 161; Inzelt, 2004) highlighting the collaboration with companies and research organizations (Inzelt, 2004; Petruzzelli, 2011).

Iterative development is characteristic to innovation processes (Dodgson, 1993), as innovations deal with high level of uncertainty and complexity. It can be said that the pursuit of innovation is the key driver and confluence of any organizational behaviour (Ibid.) leading to more and more complex activities, communication paths and networks. Indeed, innovation is crucial, as the clusters were created to renew the Finnish industry and to create breakthrough innovations. However, the process of how

innovations are developed and what kind of collaboration activities lead to innovations are the main scope of the study and not innovation per se. Thus, in order to acquire more in-depth information on the activities, the approach to the topic was in learning, knowledge management and inter-organizational context especially in the micro level.

2.2.2 Links to interdisciplinary and distributed team literature

With regard to collaborations, teamwork within an organization and between organizations are closely interlinked. Von Stamm (2003) uses terms internal and external collaboration referring to working within or outside organizational barriers. Nonetheless, both ways of working are important to innovation, have similarities as well as differences and place emphasis on group work as opposed to individual work (Tidd, Bessant and Pavitt, 2005). More specifically, the use of interdisciplinary teams share the same rationale as inter-organizational collaboration as they aim to combine different bodies of knowledge (Jassawalla and Sashittal, 1999). Indeed, inter-organizational collaboration is considered as a further construct of team working, building on project and inter-disciplinary team levels (Tidd, Bessant and Pavitt, 2005).

However, as collaboration in teams is often approached within an organization context, this stream is out of the scope of the thesis. The hypothesis is that participants joining from several organizations add special characteristics to the setting. Moreover, in general, inter-organizational collaborations are often temporary compositions where as teams in an organization tend to be more static.

In addition to interdisciplinary teamwork, distributed teamwork forms a closely related topic to R&D collaboration. Indeed, strategic collaborations and other forms of collaboration might lead to business mergers and acquisitions, which is increasingly followed by geographical diversity (Larsson, 2007). Due to this particularity of the setting, a considerable amount of communication is done online, and virtual tools are extensively used. The literature has especially focused on solving the challenges of virtual collaboration where as in this case collaboration and communication channels are reviewed broadly. Hence, this literature stream, although closely related and sharing the same incentives to facilitate and further advance the collaborative work activities, is not covered in more detail in the study.

2.3 APPROACHES TO COLLABORATION LITERATURE

2.3.1 Different definitions on collaboration

As noted, collaboration terminology is extensive, diverse and fragmented (Vyas, Shelburn and Rogers, 1995) and the variety of definitions has hindered the academic research (Trott, 2008). Collaborations contain a vast number of dimensions and the number of dimensions varies from scholar to scholar (Powell, Koput and Smith-Doerr, 1996; Harbison, Pekar and Stasior, 1998 p. 15; Pisano and Verganti, 2011 p. 18). They can exist in various forms, the number of partners can range from two to several, they can include academic institutions and other stakeholders vertically with similar stakeholders and horizontally following the product value chain, and the intensity of collaboration can be from transactional outsourcing to in-depth learning and new knowledge creation. Similarly, they can occur inter- or intra-industry, in open or

closed environment and focus on early R&D activities or on marketing partnerships close to the product launch at the other extreme.

Scholars have researched several forms of collaboration. Agreements can vary from simple handshakes at one extreme to highly detailed formal contracts, including exchange of equity or investment like in mergers, joint ventures or even acquisitions (Trott, 2008). Harbison, Pekar and Stasior (1998 p. 15) see **alliance** as an umbrella term to include a broad range of relations from short term projects between a supplier and a manufacturer to broad, long-lasting "strategic alliances in which partners tap into and learn from each other's capabilities". Similarly, Gulati (1998, p. 293) defines an alliance as any independently initiated inter-firm arrangement that involves "exchange, sharing or co-development of products, technologies or services". Other scholars emphasize the strategic angle and mutual dependence, and define alliances as contractual agreements between firms that share resources to achieve common goal and mutual benefits (Mohr and Spekman, 1994; Vyas, Shelburn and Rogers, 1995).

R&D consortium is another collaborative form to create scientific, technological and technical knowledge and knowhow (Hagedoorn, 1993). By definition one cannot differentiate a strategic alliance from a R&D consortium as in its plainest form it is a cooperation agreement that links all research parties (Ingham and Mothe, 1998 p. 250). However, (Gibson, Kehoe and Lee, 1994 p. 255) see it as "institutional mechanism for sharing resources and expertise required to conduct state of the art research and to share results in a timely manner". R&D consortia focus specifically on early state research and often contain several parties, where as strategic alliances are usually formed by two partners.

In addition to the mentioned definitions, some scholars have used terms inter-firm partnerships, inter-organizational, cross-organizational collaborations and networks. Von Stamm (2003) categorizes collaborations to internal within a firm and external between firms. To conclude, although partners and their number may vary, and intensity of the work and the form may be different, what is common to these definitions, is the use of organization's external resources to obtain something that would otherwise not be achieved.

In addition to the form of the collaboration, the number of the partners and their backgrounds may vary in collaborative activities. Collaboration occurs frequently in many supplier relationships and between firms but often these happen in other relations e.g. between universities and companies (Trott, 2008). Indeed, several researchers have investigated university-industry (UI) partnerships (Plewa and Quester, 2007; Boersma, Reinecke and Gibbons, 2008; Plewa, 2009; Chin, Yap and Spowage, 2011; Plewa et al., 2013) and even more specifically government-university-industry (GUI) partnerships (Carayannis and Alexander, 1999; Inzelt, 2004). For similar setting, some scholars (Beverland, 2000; Faerman, Mccaffrey and Slyke, 2001) use terms public-private partnerships. Moreover, they can involve different stakeholders from different stages of the product life cycle e.g. customers (Chan and Heide, 1993). Some scholars haven't identified participant backgrounds but they have noticed that varying working cultures affect the success of the collaboration.

Finally, communities of practice (CoPs) are often mentioned in collaboration literature (Veenswijk, 2010; Gertner, Roberts and Charles, 2011). Networks are often, however, unofficial and base on serendipitous activities where organizations do not actively manage them. Often CoPs are born among certain specialists or around a certain area of interest.

Several terms are used to describe the activity between partners. To describe the least dependence coordination and cooperation are often used. Collaboration and co-development are seen as more involving and express deeper interdependence and interaction. (Inzelt 2004) Co-opetition as in to collaborate and to compete is used for agreements between competing firms. It is seen as a fierce learning race between partners on who achieves the goal first and makes the most of the partnership. (Hamel 1991)

The environment of agreements has several possible characteristics. Strategic collaborations can occur intra-industry or inter-industry. (Trott 2008) The phase where collaboration activity occurs in the product lifecycle continuum can be from early R&D to product development phase and supply chain to marketing activities. Moreover, new product development literature has reasonable academic community focusing on collaboration. In addition, Pisano and Verganti (2011 p. 18) present openness dimension referring to open or closed collaboration, open-source projects and crowdsourcing being at both extremes.

Although there is some evidence that the form of the collaboration affects the outcome, this study uses **R&D consortium** referring broadly to any R&D collaboration. Although strategic alliance seems to be most commonly used in the literature and although several scholars regard it as an umbrella term for inter-organizational collaborations, it still has aspirations towards two-partner relationships and long-term commitment. Furthermore, in the case interviews, several participants used the term R&D consortium referring to the case under study. The definition understood in this study, and based on the chosen case can be described as follows: strategic collaboration is a mutual (temporary) agreement between independent companies and research organizations that share resources in joint R&D efforts. Indeed, some of the guidelines for successful collaborations are applicable in varying degree to any form of collaboration (Lynch, 1990 p. 23). Terms **R&D consortium** and **a project** are used in this thesis referring to the specific case. Speaking about collaborations in general, **strategic collaboration** is used referring to the collaborative work and the strategic nature of the activity.

2.3.2 Literature streams on strategic collaborations

Within the strategic collaboration literature, several scholars have identified three major research streams: transaction cost, strategic and learning perspective (Kale, Singh and Perlmutter, 2000; Rolland and Chauvel, 2000; Chen, 2005), although other definitions are commonly used. Two major streams evolve from the economics and transaction cost theory. **The transaction cost perspective** views collaborations as a means to reduce and minimize production and transaction costs for the firms concerned as opposed to production in-house (Hennart, 1988; Williamson and Winter,

1991). **Strategic considerations** involve using collaborations as a means to gain strategic advantage and to enhance competitive position against competitors in the changing market (Harrigan, 1986; Kogut, 1988). These two approaches are efficient in relatively stable environment but are ineffective in knowledge economy in which the creation of innovations and the ability to respond to fast-changing environments is critical (Ciborra, 1991 p. 51).

Coming to 21st century, a third approach focused on **learning and knowledge** gain in collaboration situations, has received more attention in collaboration research and appears to be promising (Hitt, Ireland and Lee, 2000; Kale, Singh and Perlmutter, 2000, p. 218; Rolland and Chauvel, 2000, p. 226). Several researchers (Kogut, 1988; Hamel, 1991; Inkpen and Crossan, 1995; Larsson, Bengtsson, Henriksson and Sparks, 1998) see collaborations as platforms for organizational learning through participants' skills, capabilities and particularly, tacit knowledge.

Linked to all approaches, some scholars have concentrated on the collaboration effectiveness and performance. The terms, however, remain fairly ambiguous, as scholars have not defined them in detail. Nonetheless, the perspective seeks to identify the enhancing or hindering factors of collaboration performance (Harrigan, 1986; Beamish, 1987; Lane, Salk and Lyles, 2001; Das and Teng, 2003).

In addition to these three main collaboration literature streams, some researchers (Miotti and Sachwald, 2003; Roman, 2009; Philbin, 2012) have taken other research perspectives. Regarding resource-based view, Miotti and Sachwald (2003 p. 1482) say that partnerships are driven by strategic resource needs. Resources can be regarded as being either tangible (e.g. physical infrastructure, equipment and materials) intangible (e.g. intellectual property, brand and culture) and human (e.g. staff and associates) (Grant, 2010 p. 127). Main motivations are risk sharing, complexity of projects and expenses. Based on this explanation, the term is closely related to transactional and strategic approaches in terms of risk and expenses sharing. In addition, RBV is used as a tool to evaluate firm's performance based on the resources it possesses (Peteraf, 1993). A complementary approach to RBV, knowledge-based view is applicable to situations where knowledge is seen as organization's main asset and a major determinant to resource exchange (Spender, 1996).

2.4 CRITICAL SUCCESS FACTORS OF COLLABORATION PERFORMANCE

Regardless of the collaboration perspective, several scholars have investigated the success factors of strategic collaborations trying to find the recipe for project performance (Kanter, 1994), where as some scholars have researched general factors that either enhance or decrease the collaboration successfulness (Vyas, Shelburn and Rogers, 1995). Von Stamm (2003) approaches the situation through factors that tend to reduce the performance.

In the following sections the main factors discovered in the strategic collaboration literature are presented. Indeed, these factors do not guarantee the success of a strategic collaboration but tend to enhance the project performance and act as

enablers. As stated earlier, each collaboration has to find unique mix of tools, methods and ways of working to support the project work. Overview of the factors found in the literature is listed in the table (Appendix 1: Success factors of strategic collaborations). The factors were first codified and then clustered into themes to clarify the connections to and effects on the collaborations.

MAKING SENSE OF THE FACTORS

As seen in the table, the use of terms is vast and diverse, and various categorizations and clusters can be identified. Some factors affect the collaboration in the beginning; some have effect on the project throughout the process. In addition, several scholars have defined the factors differently or used different terms for same factors. Moreover, several scholars have divided factors into frameworks and other categories. Ingham and Mothe (1998 p. 249) divide them into structural and behavioural factors. For instance, they state that behavioural factors such as trust and motivation/involvement emerge from collaborative processes (Ingham and Mothe, 1998, p. 260). Harbison, Pekar and Stasior (1998 p. 41) have developed an alliance formation methodology consisting of four stages: identification, valuation, negotiation and implementation. Finally, some factors have influence on operational level and some on strategic level.

In conclusion, three different approaches were identified: timeline approach including formation-process-outcome (scope of the project often refers to the outcome), strategic-operational level (strategic aspect is present in the formation, how the organization e.g. values the collaboration, operational level refers to the day-to-day activities), top-down management approach and bottom-up collaboration including communication, interaction, and learning, which are closely interdependent. The categorization in this study combines existing frameworks, models and ways of categorizing strategic collaboration. Figure 5 illustrates the categories, and the following sections discuss each of the themes and factors in more detail.

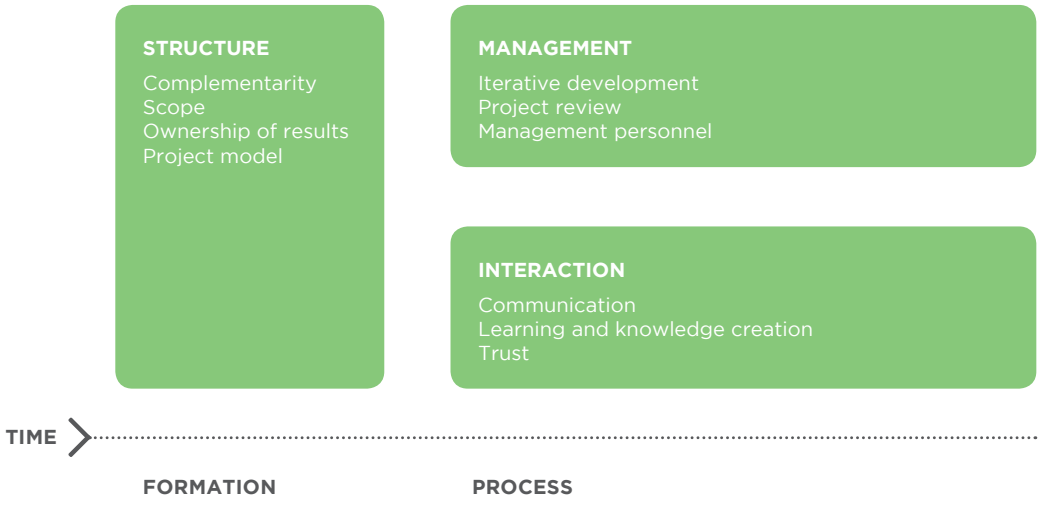

Figure 5: Collaboration success factors during the formation phase and the process.

2.4.1 Factors related to formation and structure

Project formation phase sets the base for the strategic collaboration. It is the phase when several structural factors and elements are agreed among collaboration partners having an effect on the project throughout the existence. Scholars emphasize several crucial elements to the collaboration successfulness: partners need to be carefully selected looking at complementary competence and mutual benefit in the scope setting. In addition, project structure and context have influence on the project.

COMPLEMENTARITY OF PARTICIPATING ORGANIZATIONS

Participant selection is one of the most crucial factors in entering R&D collaboration and the selection should be done based on the long term attractiveness and the interest of the project (Dodgson, 1993 p. 154). What drives the organization to collaborate with others is the access to new knowledge bases and possibility to create something together. Thus, organizations' skill-sets and know-how need to be complementary to benefit from the collaboration. Indeed, the complementarity of expertise is cited as a critical success factor in collaboration as the partners are able to learn novel skills (Ibid. p. 154).

Related to complementarity, a concept of integration has been investigated. The level of strategic intent and the differentiation of complementarities affect how tightly organizations are coordinated. The more differentiated the participants are, the more they should to be integrated in order to be successful. Being separated, the collaboration lacks operational synergy and focus to be effective (Lynch, 1990 p. 26). In addition, the more the intent of the collaboration is towards common strategic competence or products, the more organizations need to formalize its organizational routines towards that of others. Key to success is in the consistency and balance between participants' intent (Doz and Hamel, 1998).

Finally, related to participant selection, possible cultural differences between academic organizations and industrial partners need to be considered. However, results on the effect differ from scholar to scholar. Cultural differences between academia and industry are said to cause particular difficulties (Barnes, Pashby and Gibbons, 2006 p. 397). Although the academia-industry cultural gap is significant (Ibid.), problems related to it can be, however, decreased by good collaboration and project management. Some results in turn indicate fewer problems in academia-industry relationships (CBI, 2001). All these aspects of complementarity and differences between participants are reviewed in the case project.

SCOPE AND COMPLEMENTARY BENEFITS

Complementarity of the participants is, however, not enough to succeed in the project. Although knowledge bodies can be supporting, business strategies might be totally incompatible (Dodgson, 1993 p. 156). Thus, added to complementarity, common scope is emphasized to be another key success factor of the collaboration performance. Several practitioners have noted the chance of learning race and competition between the partners if there are differences between private and common benefits (Khanna, Gulati and Nohria, 1998). Another aspect is the dilemma of learning and trying to protect own core proprietary capabilities (Kale, Singh and Perlmutter, 2000). To reduce

these challenges, von Stamm (2003 p. 169) suggests clear objective statement and measurement to monitor progress. In addition, incentives to recognize and encourage collaborative behaviour should be present.

OWNERSHIP OF THE RESULTS

In addition to mentioned factors in the formation phase, the ownership of the results emerging from the collaboration is advised to decide up front to reduce tensions between participants (Dodgson, 1993 p. 156). However, there are diverse opinions on how to divide potential outcomes of the collaboration. One point of view is that one of the participants should gain the majority; another approach is that only equal ownerships of intellectual capital will result in equal interest to make the collaboration work (Von Stamm, 2003 p. 168).

PROJECT/NETWORK MODEL

The project configuration has effect on project performance (Ibarra, Kilduff and Tsai, 2005). Three main types of project configurations have been identified: star/wheel model in which all participants are connected to one another through one central participant, often being a coordinator, all-channel network model where all participants are interconnected with one another and a chain model where participants are connected with maximum two other participants creating a chain. (Evan, 1965 adapted by Bor and Boersma 2010)

There is evidence that the all-channel model improves the communication and the star model decreases the interaction between participants (Bor and Boersma, 2010). In all-channel model, participants discuss with each other and build on same issues at the same time. In the star model, most communication goes through the coordinator and only this person processes the content created in the project. Simultaneously, the possibility to use full potential of the collaboration decreases. (Ibid.)

Nonaka and Takeuchi approach the issue from knowledge creation perspective and argue that organizational structures perform differently in different knowledge functions. Hierarchy is the most efficient structure for the acquisition, accumulation and exploitation of knowledge while a task composition is the most effective structure for the creation of new knowledge. Both structures should be seen as complementary, however the project organization should be on one mode at a given time. (Nonaka and Takeuchi, 1995 p. 232)

Network model factor is linked to the complementarity and strategic intent discussed earlier. The more strategic and integrative nature the collaboration has, the more the participants are encouraged and tend to interact with one another.

2.4.2 Factors related to interaction processes and their contents

Although structural factors such as partner fit partly explain the collaboration success, the behavioural factors with regard to the links between individual participants play a major role and should be paid even greater attention (Kale, Singh and Perlmutter, 2000 p. 232). Factors are, however, closely interdependent, and so far the causal relationships between them are not widely understood. Cohen and Prusak bind them into social capital concept that consists of active connections among people that make

cooperative actions possible (2001). In addition, Kale, Singh and Perlmutter (2000) refer to relational capital, which highlights the role of trust and interaction. Components that should be taken into account and be present in the project are indeed interaction through various forms and channels and trust. Knowledge and learning, which are also related to the process phase constitute such a major topic, hence it is discussed individually in the chapter 2.5.

COMMUNICATION AND INTERACTION

The need of good communication is emphasized both within organizations and between organizations. Communication is important already in the formation phase when linkages are established. During the process, the key is to use the linkages effectively (Dodgson, 1993 p. 157). As opposed to several other scholars, Von Stamm argues that trust can be built only by facilitating face-to-face communication and cannot grow via online channels (2003 p. 170). In other words, active interaction builds and enhances trust.

Another important point in the communication process are meetings which act as moments of crystalizing the meaning of the project (Eneberg, 2012 p. 464). This point of view originates to Mandler's argument that interest is enhanced by interruptions of an on-going activity (1984). Hence, project meetings and other activities punctuate on-going activity of a long project and leads people to search for answers and to make sense of the situation.

TRUST

Trust is seen as major determinant in collaboration between organizations (Hamel, 1991; Dodgson, 1993; Snowden, 2000; Von Stamm, 2003). Although trust and interaction seem to be correlated, causal relationship has not yet been identified properly. Majority of scholars see, however, trust as an enabler for effective communication (Dodgson, 1993; Ingham and Mothe, 1998 p. 251; Wu and Yezhou, 2011 p. 195). Through effective communication in turn, knowledge transfer improves (Ingham and Mothe, 1998; Rolland and Chauvel, 2000, p. 231) and finally collaboration as a whole improves. Ingham and Mothe (1998 p. 251) argue that in addition to improving the communication, trust also enhances the accomplishment of results, improves the transparency between organizations (Hamel, 1991) and decreases the disagreement between partners. In addition, it partially substitutes contracts and institutional mechanisms (Ingham and Mothe, 1998 p. 251).

Similarly to communication linkages, trust needs to be built and maintained. It is built mainly through personal interactions. (Von Stamm, 2003 p. 167) In addition, Rolland and Chauvel claim that a form of contract based on interdependency favours trust meaning that mutual need has a stabilizing effect (2000 p. 231).

2.4.3 Management aspects of the collaboration

As stated earlier, many of the factors regarding consortium successfulness, relate to the formation and the initial conditions of the project, but often the actual success of a project lies in how they are managed and relations are built (Dodgson, 1993 p. 150; Kale, Singh and Perlmutter, 2000 p. 232). Indeed, if collaborations are becoming

increasingly common, it is essential to understand how to benefit from R&D partnerships. Management in this context is understood as managing the process and management as a role. More specifically, this sub-section discusses the operational level activities with regard to management.

ITERATIVE DEVELOPMENT

If R&D projects are especially built on future goals, management should be flexible (Harbison, Pekar and Stasior, 1998 p. 15). Approaching the management from innovation perspective, innovation process is also iterative (Dodgson, 1993 p. 152) as projects are aiming at something that cannot clearly be articulated or that yet does not exist. Thus, it is important that inter-organizational processes are not viewed as static arrangements. Projects should find effective means to respond to changing scope, knowhow needs and emerging challenges (Harbison, Pekar and Stasior, 1998 p. 15).

PROJECT REVIEW

Project review and updated milestones relate to flexible and adaptable structures and are essential due to the changing nature of collaboration environment. Indeed, "unless collaborations are dynamic in nature, they may be aiming at a target which has moved" (Dodgson, 1993 p. 157). Reviews should enable the change of the scope in the project but also to be tight enough to keep it from drifting. Thus, obtaining the balance between flexibility in objectives and their supervised control is a major management task (ibid p. 156). Project reviews relate to the meetings as crystalizing moments in the process discussed earlier.

However, scope change and iterative development do not guarantee the success of the collaboration. The organization has to be capable of adapting new information, willing to learn and change behaviour. Willingness to change relates to the culture of participating organizations discussed by Rolland and Chauvel (2000).

THE ROLE OF MANAGEMENT PERSONNEL

The literature has noticed the importance of strong leaders in the collaboration project and three different roles have been identified. Barnes, Pashby and Gibbons, (2006) emphasize the presence of a collaboration champion as a leader and influencer in a project. This champion role is regarded as a higher-level factor. The top management acts as an organizational authority to access key resources to support the project initiative (Dyer, Kale and Singh, 2001). The commitment needs to be present, both on the operational level and top management level. The role of a project manager is to integrate differing objectives and operations in the organizations (Barnes, Pashby and Gibbons, 2006).

2.4.4 Challenge of researching collaboration successfulness

Although collaborations have become more and more popular, results on the collaboration success are diverse. In general, huge proportion of organization's R&D activities is unsuccessful (Ohmae, 1999). There are implications that half of the collaborations (Kalmbach and Roussel, 1999; Kale, Dyer and Singh, 2001, p. 217) or even 90 per cent (Ohmae, 1999) of them fail. Indeed, collaborations contain a high proportion of risk and the setting is naturally tension ridden due to partner

opportunism, goal divergence (Doz, 1996), cultural differences (Kale, Singh and Perlmutter, 2000), the dilemma of trying to learn and trying to protect (ibid p. 217) and complex and uncertain process (Dodgson, 1993 p. 150).

There is no complete agreement about the reasons for failure (Dodgson, 1993), but challenging circumstances partially explain the high failure rate. In addition, several scholars admit that collaborations are indeed difficult to manage (Devlin and Bleakley, 1988; Lynch, 1990). Additionally, even measuring success is difficult as participants' opinions on circumstances in and expectancies of collaborations are so different to make uniform definitions of success and failure (Dodgson, 1993 p. 151). Gulati (1998, p. 306) points out that measuring performance is indeed difficult and the collection of rich data necessary to investigate the issue in more detail is rather challenging. The situation is further complicated as the scope of the collaboration may change over the course of the process (Ingham and Mothe, 1998 p. 250). Although the actual outcomes are not what initially are expected, the collaborations might not be less successful (Dodgson, 1993 p. 152). This is in line with the innovation process, i.e. management should be flexible and lean.

Furthermore, no generalizations of how to best manage a collaboration cannot be given as each project and circumstances are unique (Lynch, 1990 p. 22; Dodgson, 1993 p. 152). To conclude, the first part of the thesis goal aims at seizing these challenges: to take an in-depth look on one case, to understand the details of the collaboration and to give further project specific implications to enhance the process still in its existence.

2.5 LEARNING AND KNOWLEDGE MANAGEMENT PERSPECTIVE

As stated earlier, given the importance of organizations' intangible resources, the emphasis of this study is on the knowledge and learning perspective in strategic collaborations. Indeed, the need for organizations to change continuously and to interact with their circumstances has been growing due to the globalizing economy and ever increasing technological change (Nonaka and Takeuchi, 1995 p. 44). As in inter-organizational collaborations, knowing how organizations learn and apply knowledge has also become a crucial competitive advantage. Strategic collaborations are widely studied but deeper understanding of the factors enhancing knowledge creation and learning in R&D collaborations needs further examination.

As learning, knowledge creation and its effective management and facilitation are closely interwoven; topics are discussed together in this section. First, central definitions, learning and knowledge creation are presented, and then the expansion of learning from individual to higher levels is discussed. Finally, the main literature findings on management and facilitation aspects in regards to learning and knowledge are presented. Factors related to knowledge management are shortly reviewed.

2.5.1 Organizational learning and knowledge creation

To understand the mechanics of organizational learning, one needs to understand how individuals learn. Indeed, organizations ultimately learn via their individual members and due to this, theories of individual learning are crucial for understanding learning

on organizational level (Kim 1993 p. 37). The transfer mechanism from individual to organizational level is in the heart of organizational learning: "the process through which individual learning becomes embedded in an organization's memory and structure" (Ibid.).

LEARNING AS A CONCEPT AND INDIVIDUAL LEARNING

Before immersing in learning transfer mechanisms, the concept of learning must be understood. It is an ill-defined concept but widely accepted definition is acquiring of knowledge or skill. That is, *learning* includes two meanings: 1) the acquisition of skill or know-how referring to the ability to produce an action and 2) the acquisition of know-why, which refers to the ability to constitute to a conceptual understanding of an experience (Kim, 1993 p. 38; Nonaka and Takeuchi, 1995). For the same two-fold meaning Kim uses term *operationa*l and *conceptual* learning (Kim, 1993). Nonetheless, both meanings are important: what people learn (know-how) and how they understand and apply that learning and how they construct new understandings (know-why). How knowledge and learning are linked in turn, Weick and Fiol and Lyles offer a point of view: insight and knowledge development between past and future actions constitute learning (Fiol and Lyles, 1985, p. 811; Weick, 1991, p. 122).

What is closely linked to learning is the role of memory, understood as active structure that affects thinking process and the actions taken. Senge (1990) introduces a concept of *individual's mental model* that represents a person's view of the world, provides the context in which to view and to interpret new material and information and defines how acquired knowledge is relevant in a given situation.

TACIT AND EXPLICIT KNOWLEDGE

Several scholars (Nonaka and Takeuchi, 1995; Ingham and Mothe, 1998; Rolland and Chauvel, 2000) identify two characteristics of knowledge referring to Polanyi (1966): tacit and explicit. Tacitness refers to personal and context-specific knowledge, which is attached to actions and experiences. It is more challenging to communicate and it is best transferred through practice and social interaction. Explicit knowledge in turn is easy to transfer and communicate and it can be codified or expressed in artefacts and processes. From collaboration perspective, the most valuable knowledge is often tacit and embedded in organizational routines (Zack, 1999 p. 128). Utterback et al. (2006 p. 117) in turn emphasizes the need of both types of knowledge; development of a product means solving a problem by blending tacit and explicit knowledge.

NONAKA AND TAKEUCHI'S KNOWLEDGE SPIRAL

Nonaka and Takeuchi's framework serves as a common theory to organizational knowledge creation and the process of managing it (Nonaka and Takeuchi, 1995). Adding to other scholars' work Nonaka and Takeuchi emphasize the active interaction between tacit and explicit knowledge. The framework consists of two dimensions: the interplay between tacit and explicit knowledge and the knowledge level from individual, team, organizational and finally, inter-organizational level (figure 6).

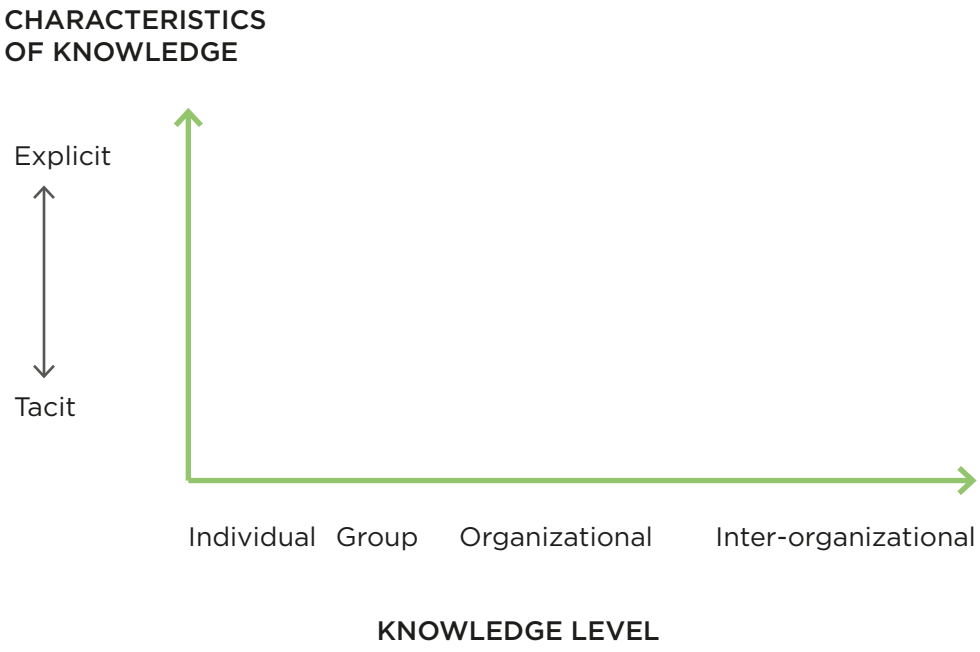

Figure 6: Two dimensions of Nonaka and Takeuchi's knowledge creation framework (adapted from Nonaka and Takeuchi, 1995 p. 57)

Nonaka and Takeuchi's critical assumption is that the knowledge is created and expanded through social interaction between tacit and explicit knowledge. This is called *knowledge conversion* and it is a social process between individuals. Knowledge conversion consists of four different modes: 1) socialization from tacit to tacit, 2) externalization from tacit to explicit, 3) combination from explicit to explicit and 4) internalization from explicit to tacit. The interplay between tacit and explicit knowledge is spiral and interactive, and all modes complement each other. The following figure 7 illustrates the different modes.

Converting tacit knowledge to tacit is called socialization. It is a process of sharing experiences and creating tacit knowledge such as shared mental models and technical skills. Key to acquiring tacit knowledge is **experience** and it is strongly context specific. Socialization often can happen without using language through observation, imitation and practice. In the organizational theory, socialization is strongly linked to group processes and organizational culture. (Nonaka and Takeuchi, 1995 p. 62)

Externalization is a process of converting tacit knowledge to explicit, often transforming it into metaphors, analogies and concepts. In externalization mode, explicit knowledge is always an expression of tacit unit, which is often inadequate and insufficient. However, such gaps can be diminished by **reflection and interaction between individuals.** Externalization is the key to knowledge creation, because it creates new, explicit concepts from tacit knowledge.

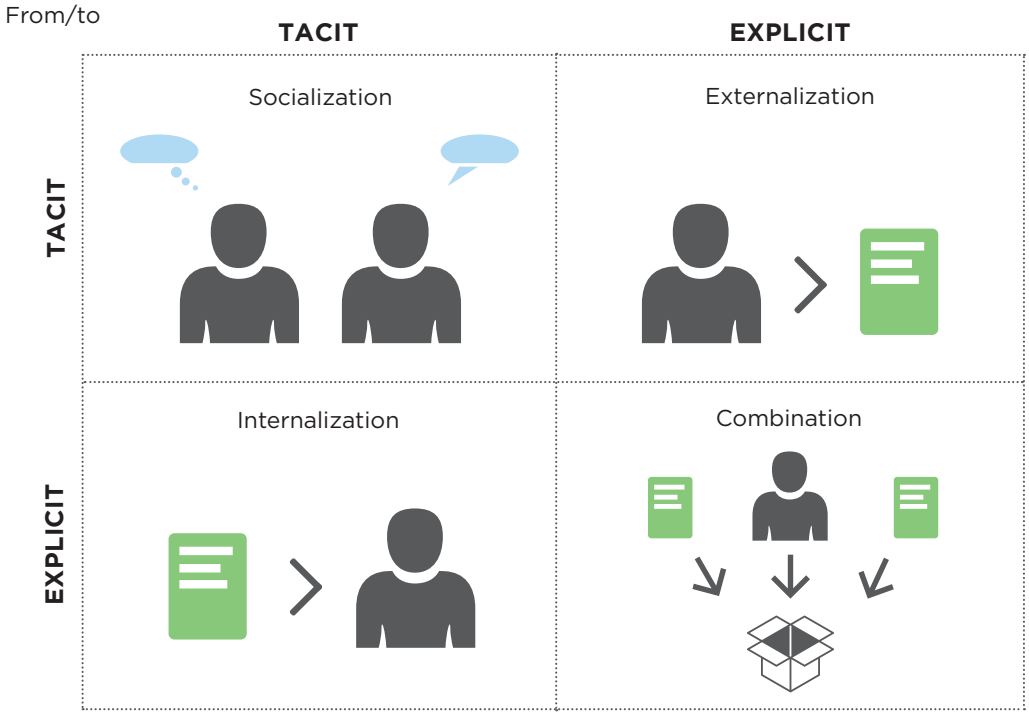

Figure 7: Four modes of knowledge creation (adapted from Nonaka and Takeuchi, 1995).

Combination is a process of systemizing concepts into a knowledge system. This mode involves **combining different bodies of explicit knowledge**. The process happens through e.g. documents, meetings, and telephone conversations. Middle management plays a critical role in creating new concepts through networking of codified information and knowledge.

Internalization is a process of embodying explicit knowledge into tacit knowledge. It is closely related to **learning by doing**. To make the change of explicit knowledge to tacit, the knowledge should be verbalized into documents, manual or oral stories. Documentation helps individuals internalize what they experience, and documents and manuals facilitate the transfer of explicit knowledge to other people. However, for organizational knowledge creation to happen, the tacit knowledge created on individual level needs to be socialized with other organizational members, thus starting a new spiral of knowledge creation.

DIFFERENT LEARNING MECHANISMS

Where as Nonaka and Takeuchi emphasize the need for all knowledge creation and conversion modes, other scholars state that some of the modes are more effective than others.

In the context of learning in a collaboration, Sluyts et al. (2011, p. 877) investigated four types of alliance learning mechanisms: codification, sharing, articulation and internalization. Codification refers to written tools or templates to support day-to-day project management. Sharing happens often through meetings or brainstorm sessions and is similar to Nonaka and Takeuchi's socialization knowledge mode. Articulation processes e.g. reports and presentations point towards making knowledge more explicit referring to externalization. Finally, internalization (same as Nonaka and

Takeuchi's fourth mode) is understood as absorbing the available knowledge through e.g. trainings.

Sluyts et al. come, however, to a conclusion that collaboration codification (supporting management tools) and sharing (socialization) processes have a significant positive effect on the outcome. "Codification tools such as checklists, guidelines or manuals allow the firm to facilitate the dispersion of existing knowledge and help to replicate best practices within the firm. Through sharing mechanisms such as seminars, job rotation or task forces, employees are encouraged to exchange information, best practices and knowhow to peers." (Sluyts et al., 2011 p. 882)

Both Heimeriks, Klijn, and Reuer (2009) and Sluyts et al. (2011) find that practices such as formal reports or debriefings and alliance training (internalization) do not have a significant effect on the performance. This research result is in contradiction also with Cohen and Levinthal (1990) as they in turn emphasize the efficiency of learning by doing (internalization mode). The existence of different learning and knowledge creation mechanisms are explored in this case study and the meaning of different modes is discussed in chapter 5.

EXPANDING LEARNING TO HIGHER LEVELS

Organizational learning is much more complex than simply a higher construct of individual learning as factors such as motivation, diverse individuals and management affect it. In addition to the individual learning, a system for capturing it evolves (Kim, 1993). Most importantly, knowledge creation is fundamentally a social process. As Nonaka and Takeuchi state (1995 p. 230), human knowledge is created and expanded through the social interaction between tacit and explicit knowledge. This social aspect of knowledge is reviewed in the case under study.

According to Argyris and Schön (1978), organizational learning takes place through individuals whose actions are based on a set of shared models (Kim, 1993). In other words, what affects the organizational learning is the organizational memory, similarly as that of to individual learning discussed earlier; it is the active memory that remains relevant. What the memory thinks, chooses to act and what it remembers from past experience – that is altogether individual and shared mental models. (Kim, 1993 p. 44)

Similar principles apply to both organizational learning and knowledge creation: only individuals create knowledge, and an organization cannot create without individuals rather it gives support and context for them to create knowledge. Nonaka and Takeuchi (1995) argue that individual tacit knowledge is the starting point of organizational knowledge creation. Through the four modes of knowledge creation, knowledge is amplified as a spiral to higher levels from individual to communities of interaction, crossing departmental and organizational boundaries. An organization is thus a complex system of different types and levels of knowledge in which individuals hold an important role (Rolland and Chauvel, 2000 p. 227), inter-organizational level bringing even more complexity to the situation. To summarize, knowledge is characterized as tacit and explicit, and in general, both characteristics are considered significant. Different knowledge creation mechanisms exist, the literature is not however, in line with their importance to the organization. An individual is the starting point of

knowledge creation, and through complex processes the knowledge is transferred to higher levels.

In the process of organizational learning a company and its activities play a major role. “Motivation is essentially individual in the short term, but has to become organizational medium term in order to facilitate the transfer from individual to organizational learning and to take advantage of this knowledge”. (Ingham and Mothe, 1998, p. 260) This management aspect is discussed in the next section.

2.5.2 Management and facilitation of knowledge creation

Projects may be seen as knowledge management processes (Sauer and Reich, 2009). As in projects existing knowledge brought by participants is applied and new knowledge is created during the project, it becomes essential to understand how to appropriately manage that knowledge. Indeed, according to Nonaka and Takeuchi (1995 p. 56), organizations do not simply absorb and process information from outside, but also create new knowledge and information from inside out. Moreover, knowledge management is highly essential especially in complex projects: lack of it is one of the main reasons why projects fail (Desouza and Evaristo, 2004). Knowledge sharing and transfer is actually often more difficult than organizations expect (Gupta and Govindarajan, 1991). Several tools and channels help managing explicit knowledge, but it is the tacit knowledge that causes major challenges (Grant, 2000 p. 50–51).

KNOWLEDGE MANAGEMENT DEFINITIONS

There are two kinds of groups in knowledge management definitions: one sees knowledge management as processing a single element of knowledge and lists functions of its life cycle. Another group of knowledge management definitions focuses on the whole knowledge possessed by individuals and organizations and the benefits of this application. (Gasik, 2011) Dalkir (2011 p. 4) and Wu and Yezhou (2011) combine both definitions placing importance on the performance improvement through new knowledge. Indeed, both perspectives are significant to the case under study, as the aim is to understand the whole process how knowledge is created, transformed and shared and stored and the management of knowledge bodies possessed by different participating organizations.

SUPPORTING FACTORS

An *organization can support* knowledge creation by providing a proper context for facilitating group activities (Nonaka and Takeuchi, 1995 p. 74). It has been shown that the direct involvement of top management in knowledge related activities increases the learning capacity of the partners through the improvement of individuals’ involvement and motivation to the collaboration issues (Rolland and Chauvel, 2000 p. 234) as their effort gives signals that the collaboration is valued (Child, 2001). In general, learning is best achieved through continuous and long partnerships, and it is the quality of the relationship that enables the full realization of the collaboration (Kale, Singh and Perlmutter, 2000 p. 233). The quality of the relationship can be broken into more detailed factors. Among of them are trust, demand-incentive, motivation and culture.

As in strategic collaborations, *trust* is a significant factor in organizational learning and it is especially present on individual level (Wu and Yezhou, 2011) in line with Abrams, Cross, Lesser and Levin (2003). Dyer and Singh (1998), Dyer and Nobeoka (2000) and Kale, Singh and Perlmutter (2000 p. 232) argue that trust encourages organizations to set up particular activities that facilitate learning between participants.

Motivation is said to be the starting point of learning process (Ingham and Mothe, 1998 p. 252). "Motivation is essentially individual in the short term, but has to become organizational in the medium term in order to facilitate the transfer from individual to organizational learning and to take advantage of this knowledge" (Ibid. p. 260). The degree of learning is directly proportional to the interest and involvement in the collaboration (Ibid. p. 259).

Culture of the participating organizations is essential in R&D collaborations. "Because culture situates, defines and prescribes the routines and habits that influence how members learn and communicate, and the extent to which they do, cultural differences lead to difficulties, and adjustments aimed at reducing cultural distance are often perceived to be necessary"(Rolland and Chauvel, 2000 p. 230). Open and flexible cultures (Schein, 1990) create and transfer knowledge more effectively as open cultures have more tendency to engage in learning by doing activities (Rolland and Chauvel, 2000 p. 231), information is better accessed, errors and problems are more easily shared and conflicting views are accepted (Child, 2001). Flexible cultures, on the other hand, have an ability to modify their routines, processes or value chains to better adapt strategic direction to a given context (Rolland and Chauvel, 2000 p. 231). How an organization enhances the culture of knowledge transformation is by recognizing, encouraging and giving *incentives* to those activities.

PRACTICES SUPPORTING KNOWLEDGE RELATED ACTIVITIES

As tacit and explicit knowledge are both important in R&D projects, practices supporting the creation of both knowledge types are important to facilitate in projects. If knowledge is explicit, what is common in today's development work is the use of different communication technologies, especially between dispersed project participants. Explicit knowledge can be articulated in manuals, processes and reports and the main task is to ensure that the knowledge is shared and transferred (Rolland and Chauvel, 2000 p. 233). Intranets, manuals, reports, groupware and other information systems are proven to be efficient in explicit knowledge storage and transfer (Grant, 2000 p. 53). However, these kinds of technologies cannot transfer related sensory information, feelings, intuition and non-verbal communications that are important to the knowledge ultimate implementations (Boutellier, Gassmann, Macho and Roux, 1998).

Thus, if the knowledge is tacit, it is fundamentally important to support social processes like face-to-face communication and meetings to ensure knowledge blending (Rolland and Chauvel, 2000 p. 233). By working together, individuals are able to build personal connections that facilitate knowledge transfer (Utterback et al., 2006 p. 118). Examples of the second issue include face-to-face communication, apprenticeship, mentoring systems, community creation, staff rotation, informal information exchanges and colocation of project teams, that is interactive learning. (Rolland and

Chauvel, 2000 p. 233) The key insight is that rather than managing the knowledge itself, the organizations "must manage the social environment in which motivated people are allowed to think and work together" (ibid.).

2.6 CONCLUSIONS ON THE LITERATURE REVIEW

This study focuses on the latest stream on strategic collaborations, learning and knowledge gain and sees the collaborations as strategic activities to innovate and to gain competitive advantage in the market. As noted, although current literature states that strategic collaborations are widely studied, the understanding of the factors enhancing knowledge gain and learning in the context of R&D collaboration is not sufficient.

Factors influencing the project performance can be divided into 1) formation and structural factors, 2) factors related to the bottom-up interaction processes and 3) top-down management aspects. What initially leads to a potential strategic collaboration is the complementary expertise of the participating organizations. Furthermore, the scope and the benefit of the project must be mutual. The project network model can be from loose to tightly integrated. The more strategic characteristics the collaboration involves, the more actively the participants tend to work with each other. Finally, the ownership of the results of the project should be agreed in advance. Factors that affect the interaction are trust and communication. These factors are seen highly important already in the formation phase but also they need to be nurtured throughout the existence of the project. Third cluster of factors relate to the management approach. First, especially when dealing with innovative projects, management should be iterative. The iterative process should be reviewed occasionally to maintain the right scope. Second, the management personnel play a major role in the performance of the project, emphasizing both strategic top management and operative coordinator roles.

Related to learning and knowledge creation, one of the fundamental issues is the tacit and explicit characteristic of knowledge. Learning in turn can be understood as the creation and application of knowledge and management is the top-down perspective how to manage and facilitate that process and to integrate that to other organizational processes. Person's individual mental model (i.e. how the person perceives the world and interprets information) affects the individual learning and shared mental models affect organizational and inter-organizational learning. In learning literature, one of the widely studied frameworks is the four modes of knowledge creation by Nonaka and Takeuchi (1995). In their framework, knowledge is continuously changing between tacit and explicit through four different modes: socialization, internalization, externalization and combination.

Due to the changing characteristics of knowledge, suitability of different knowledge creating and transferring activities vary. Due to the same reason, different types of knowledge are expanded differently to higher organizational levels. Moreover, opinions differ on the importance of knowledge types. This distinction in turn affects the discussion on the activities that best support strategic collaboration. According to Zack (1999), tacit knowledge (which is shared best in social interaction) is more valuable in strategic collaborations, where as Nonaka and Takeuchi argue that

knowledge creation is fundamentally a social process and all modes of knowledge creation are equally important. Nonetheless, results point towards a significant emphasis on the sharing of knowledge and active interaction between participants.

To summarize, this study seeks to discover answers to the several open questions on the knowledge gain and learning appropriation in strategic collaborations posed by scholars. Literature review acted as an inspiration and initial approach to the topic and revealed the general mechanism of strategic collaborations. Next chapter presents the methodological procedure on the empirical research of the study, setting out to understand collaboration in one particular R&D consortium.

3 APPROACH AND METHODOLOGY

"Enter into the world. Observe and wonder; experience and reflect. To understand a world you must become part of that world while at the same time remaining separate, a part of and apart from."

- Michael Patton (1980)

In order to understand the collaboration process between individual participants and the influencing factors behind it, the methodological choices play a major role. In this chapter, the research methodology behind the study is covered. The chapter describes used data sources, collection of the data and finally, the analysis procedure. Although the case choice was partly assigned by the role of Aalto Design Factory in the project, it still allows discussing the research design, the theory of case study method and qualitative research.

3.1 COLLABORATIVE R&D PROJECT AS A SINGLE CASE STUDY

Yin (2009 p. 8) presents three conditions that affect the research method choice that is going to be used. First, the type of research question posed, second, the degree to which the researcher is able to affect the behavioural events and third, the focus on contemporary events as opposed to historical events. If the study approach is based on the questions "how" and "why", case study, histories and experiment methods are suitable. What further distinct the mentioned three methods are the control of behaviour in and the contemporary nature of the events. The case study method is preferred in investigating contemporary events that are not manipulable, whereas histories are suitable for examining events that took place in the past and experiments are done when the researcher can manipulate the behaviour directly and systematically (Ibid.). Indeed, the case of this study is a single collaboration project in R&D context. Following the questions proposed by Yin, this study tries to form an in-depth understanding on the collaborative aspects between project participants. The project was on going during the research period and events observed during the research were not systematically manipulated, rather it was participative observation, which validates the choice of case study research approach.

Even approaching the phenomenon through case study method, one needs to make a choice between single and multiple cases, what is to be studied (Maxwell, 1996 p. 69; Stake, 2005 p. 445). This study focuses on one case, which aims at understanding the dynamics within single settings (Eisenhardt 1989 p. 534). Rationales for using a single case design are several (Yin, 2009). One of them is where a particular case represents a unique case. A case is chosen due to its "particularity and ordinariness" and the case itself is of interest (Stake 2005 p. 445). Indeed, the SHOK collaborations are unique with regard to nation, industry, new project governance and future-oriented innovative goals. Another purpose of choosing a single case is that research aims at better

understanding of the case as opposed to theory building (Ibid.). This purpose also applies to the case of this study, a single R&D collaboration project, as Lynch (1990 p. 22) states, that there is not a single "correct solution or answer for every alliance; each one must be designed and managed in its own unique fashion to fit its own circumstances". There are numerous motives, structures and outcomes in collaborations, thus generalizations about how to best manage them can not be applied to all cases (Dodgson 1993 p. 152). Furthermore, the motive was to form a holistic understanding of one particular project, thus research resources were targeted to understand one case thoroughly as opposed to taking a glance of several cases. The case limits to investigating a single R&D project under health and wellbeing cluster and the participants forming the project are both private companies and research organizations.

If case study method is favourable to explore the "hows" and "whys" of a certain phenomenon, the same questions are typically investigated by qualitative methods (Guest, Namey and Mitchell, 2013 p. 1) as opposed to quantitative methods. Qualitative methods are discussed in the next chapter.

3.2 QUALITATIVE RESEARCH APPROACH AND RESEARCH PROCESS

Case studies are a common way to do qualitative research (Stake, 2005). "Research studies that are qualitative in nature are designed to discover what can be learned about some phenomenon of interest, particularly social phenomena where people are the participants" (Maykut and Morehouse 1994 p. 43-44). Maxwell presents several research purposes especially suitable for qualitative methods:

1. ***Understanding the meaning*** of situations, events and actions participants are involved with.
2. ***Understanding the particular context*** within which the participants act and ***the influence*** that this context has on their actions.
3. ***Identifying unanticipated phenomena*** and influences.
4. ***Understanding the process*** where events and actions take place.
5. ***Developing causal explanations*** where e.g. the influences of certain events on a process are investigated. (Maxwell 1996 p. 19-20)

Furthermore, qualitative research has a particular advantage in **practical** purposes:

1. Generating results and theories that are understandable and experientially credible, both to the people, which are studied, and to others. (Maxwell 1996 p. 21)
2. Conducting formative evaluations, ones that are intended to help improve existing practice done (Scriven, 1991).
3. Engaging in collaborative or action research with practitioners or research participants. (Maxwell 1996 p. 21)

To varying degrees, all these purposes apply to the case under investigation. Especially the focus is on practical implications for the case.

Qualitative research methods were chosen as they allow exploring the "inner experience of participants to determine how meanings are formed and to discover rather than test variables" (Corbin and Strauss 2008 p. 12). What can be discovered by qualitative research are no sweeping generalizations but contextual findings (Ibid. p. 21).

Although qualitative research is rather open-ended, it still has a focus. It is "initially broad and open-ended, allowing for important meanings to be discovered (Maykut and Morehouse 1994 p. 43). The open-ended focus also applies to the case of the study, as the goal is to understand what happens in the project on individual level, how do the participants interact and what are the collaboration factors affecting the project. Goals were left intentionally open instead of forming more detailed research questions. In the method choice, the open focus was applied in semi-structured interviews and enabling a free-form discussion and the emergence of the topics from the interviewee's personal experiences.

What is essential in qualitative research is the research instrument. Researcher acts as a human investigator, who can explore the atypical and idiosyncratic data that comes from the person or activity, which would not be possible for any other instrument (Lincoln and Guba, 1985). Human investigators are able to capture what people say and do, and how they interpret the world. It requires the ability to reproduce the feelings, motives and thoughts behind actions in researcher's mind (Bobgen and Taylor, 1975 p. 13-14). It is a delicate task to stay close to the original experience of the participants and at the same time to find the patterns behind the words and actions and present those to others (Maykut and Morehouse 1994 p. 18). The challenge can be overcome through "close observation, careful documentation and thoughtful analysis of the research topic" (Ibid. p. 18).

As noted in the literature (Gulati 1998 p. 306), investigating strategic collaborations and their management and collaboration factors is challenging, as e.g. collecting relevant data is difficult. This is why qualitative approach was taken in this study and human investigator as a research instrument was used. This instrument choice aimed at collecting rich, in-depth data from the case and finding meanings from the words, actions and behaviour of the participants to overcome the challenges mentioned earlier. Furthermore, the data gathering methods contained participative observation to form more accurate understanding on the interviewees' perceptions and actions.

Qualitative research process was partly *emergent* and sequential and partly *non-emergent* (Maykut and Morehouse 1994 p. 44). In emergent research design the research plan is only initial, the insights and results that emerge guide the process further. Emergent approach was used first in choosing the interview participants, as contacting the initial ones lead to new potential contacts and second, as the issues of knowledge transfer and individual learning emerged from the first interviews, knowledge management and organizational learning literature streams were emphasized in the theoretical part of the study. Non-emergent research design, where the data is first collected and then analysed, was used, when the collection of interview data was limited to a certain period of time due to time constraints of the project work.

To summarize, combining the first part of the research goal which is to understand the project context and process, qualitative research is especially suitable, as the interest is in the events in the process that lead to the outcomes of the project (Merriam, 1988, Patton, 1990). Furthermore, as each of the collaboration processes is unique, a single case was chosen to due to its particularity. Both case study research and qualitative research are optimized to in-depth understanding rather than generalization.

3.3 PURPOSIVE SAMPLING WITHIN THE CASE

Even within the case one needs to make sampling choices what is to be studied. Sampling applies to both the number and the quality of samples. Whenever the focus is on understanding people, the sample size should be small (Koskinen, 2003). Maxwell (1996 p. 17,19) continues the topic by stating that "qualitative researchers typically study a relative small number of individuals or situations and preserve the individuality of each of these in their analyses, rather than collecting data from large samples". The effort is directed to forming a deep understanding of a specific case (Koskinen, 2003) rather than creating a generalized, universal picture of the phenomenon. Indeed, as stated before, as the purpose was to understand the collaboration in a single setting and to dive into the daily lives of the research participants, the resources were targeted to relatively small number of representatives (ten interviewees) of the project.

With regard to *sample size,* scholars discuss data saturation, i.e. when no new data emerges although sample size increases (Maykut and Morehouse, 1994; Marshall, 1996). Indeed, the success or impact of data collection can be measured as the difference in the understanding prior to the study and after it (Koskinen 2003 p. 64). Sample size can also be defined by looking at the number of samples adequately answering to the research goal (Marshall 1996 p. 523). In the case, the planned sample size was not strictly predefined; rather it was an estimate of number of interviews needed. Certainly, it is impossible to know a set moment of data saturation in advance, but after a certain amount of interviews, particular themes and patterns emerged several times, and no new relevant insights were found.

In qualitative research the goal is not to collect a random sample, but to select the persons or settings that are thought to represent a large variety of experiences on the phenomenon under scope (Maykut and Morehouse 1994 p. 57). Participants are carefully selected based on the potential that each sample will increase the range of experiences of the case (Ibid. p. 45). In other words, *purposive sampling* is to select the most productive sample to reach the research goal (Marshall, 1996). More specifically, *maximum variation sample* is commonly used in qualitative research as it tries to capture the heterogeneity of the target (Maxwell 1996 p. 71). Thus, in this particular case, the aim was to cover all possible point of views, which lead to the decision to intend to interview employees from all participating companies and research organizations. To broaden the perspective, in each of the organization a researcher and a manager was purposefully selected and interviewed. As there was no participant contact list available, *snowball sampling technique* (Maykut and Morehouse, 1994; Marshall, 1996) was used to gain access to more potential interviewees. This sampling technique links the study to emergent research design discussed earlier.

However, all intended candidates were not reached. Thus, compromises had to been made and the ones that were willing and able to participate were selected. As Stake (2005) argues, the researcher has to choose the cases, which give the best *opportunity to learn.* This may involve compromises in the decision making, as issues such as gaining access and willingness to participate need to be taken into consideration. The fact that two of the intended candidates were not reached might have had influence on the results, and could have brought more light to the reasons why the collaboration was not useful. The candidates represented one company and one research organization that left the project in the early phase. One participant representing a company no longer part of the project was however interviewed. Thus, the perspective of not to take part in the project is partially covered.

Regarding sample variation to collect as rich and meaningful data, both research and managing roles and representation of business and academia were most important *variables.* Gender was not itself a main variable, as there was no ability to choose participants due to the small total number of representatives in the case. Several researchers claim that there are gender differences in how knowledge is received, understood and integrated (Belenky, Clinchy, Goldberger and Tarule, 1986; Maykut and Morehouse, 1994). However, this variable was included in the final sample, as both males and females were interviewed. In addition, each geographical location was covered in the sample.

3.4 DATA COLLECTION METHODS

Case study research typically relies on multiple sources of data (Eisenhardt, 1989; Yin, 2009 p. 19). "The data of qualitative inquiry is most often people's words and actions and thus requires methods that allow the researcher to capture language and behaviour" (Maykut and Morehouse 1994 p. 46). Indeed, in this study, interviews, observation and other supportive document collection formed the main research methods, which are most commonly used ways of gathering qualitative data (Ibid.). Main source of information relied on interviews and supportive data was gained through observation and participation in the project activities, e.g. meetings, workshops, phone conversations, and project support material, e.g. reports and meeting minutes. During the activities, notes were taken on relevant issues and a brief summary of the activity was written. Interviews and observation are discussed in more detail in the following subchapters.

3.4.1 Interviews

As a main method of data gathering, ten semi-structured interviews (Dicicco-Bloom and Crabtree, 2006 p. 315) were conducted individually with one researcher and one manager from each participating organization. Detailed description can be found later in this section. Interview outline formed the structure of the interview. The interview outline consisted of nine main themes: *Background and participating employees, goal of the project, collaboration in the project, roles, communication, documentation, motives*, *benefits* and *needs*. A majority of the questions were formed based on the main findings from the literature, one part seized the participants' background information, and third part was formed from researchers' own insights relevant to the

topic. All interviews were held in Finnish to ensure effective communication with the interviewees.

In the beginning of the interviews, the goal of the research and the structure of the interview was explained, i.e. the themes of the outline. Open-ended questions were followed by a free-form conversation. All interviews were recorded, and in addition, a field report was written on each of the interview situation recording personal perceptions and conversation that was not recorded. In many occasions, the discussion on the topic continued before and after the official interview. The field reports were written immediately after the interview.

The initial contact to ask permission to conduct an interview was made through email. The contact details were accessed from a board meeting email list. Two of the interviewee contacts were formed in the executive board meeting in April 2013. The representatives of each participating organization were contacted via email. Through these email conversations, representatives suggested other potential interviewees in that particular organization. If the contacted people were not reached via email, they were contacted personally via phone or the office was visited directly. One university representative and one company representative, who were part in the beginning of the project, were not interviewed. The effect on the range of the data is discussed in the chapter 6 in more detail.

All interviews took place in April and May 2013, and all interviews were conducted in the interviewee's premises except the pilot interview, which was executed at the Aalto Design Factory. Interviews lasted from 20 minutes to 1 hour 30 minutes averaging at 45 minutes. The longest interview was conducted with the coordinator of the project. The person's position and role in the work package might have affected the length of the interview.

In total of ten interviews were conducted of which the first one was a pilot interview. For the pilot interview, initial version of the interview was prepared and the project coordinator was interviewed. After the interview, some modifications, additions and deletions to the interview questions were made to better discover the nature of the collaboration, affecting factors and enablers. For the rest nine interviews, a modified interview outline was used.

To form a holistic overview of the project, individuals from all participating research organizations and companies in the work package were interviewed. Eight of the interviewees were working in research organizations (two interviewees from each research unit location) and two interviewees represented private sector (one current company representative and one representative from a company that was initially taking part in the project). Due to the low number of participating companies in the work package the number of company interviews was only two. Four out of the eight research organization participants were researchers and four worked in managing roles in the unit and the project. Figure 8 illustrates the backgrounds and roles of the interviewees. In addition to Aalto University, three research organizations and one company were part of the project.

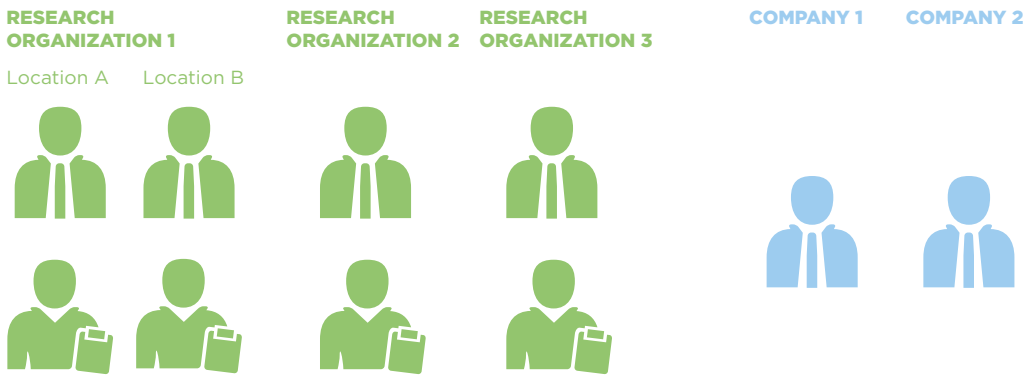

Figure 8: The number of interviewees and their backgrounds: eight interviewees from research organizations and two from private companies. Half of the research organization interviewees were researchers and another half managers.

3.4.2 Observation

To form a holistic understanding on the participants' every day life, it was important to visit participating organizations' premises. Indeed, participant observation can be defined as observing the natural setting where the phenomenon under study takes place. "The natural setting is the place where the researcher is most likely to discover or uncover what is to be known about the phenomenon of interest" (Maykut and Morehouse 1994 p. 45).

What is beneficial in observation is that it combines document analysis, interviewing of participants and direct observation (Denzin, 1978 p. 183). It can reveal new meanings and perspectives that could not be discovered by relying only on interview data (Maxwell 1996 p. 76). What qualitative research emphasizes is that one needs to understand the surrounding context of a person or phenomenon in order to understand the person or the phenomenon itself (Maykut and Morehouse 1994 p. 33). Indeed, to form an in-depth understanding on the project and the participants, it was essential to see their everyday life at work.

The strategy to do observation in this study was to conduct the interviews in participants' own workplaces. This was beneficial in two ways: first, people were interviewed in their natural surroundings (IDEO, 2009) and second, the environment where research actually takes place was explored. Interviewing people in their natural surroundings makes most interviewees more comfortable and simultaneously these insights can be validated by the observations of the interviewer (Stickdorn and Schneider 2010 p. 163). In-context interviews give the participant greater ease and allow the researcher to see the objects, spaces and people that they talk about during the interview (IDEO 2009 p. 42).

Through observation, the aim was to experience both the individual work and the collaboration in the project, as it is important for the researcher to have personal experiences and to be involved with the space to better understand the situation of the participants (Stanford 2010 p. 1). Thus, in addition to interviewing and visiting all company and research organization premises, project related meetings were

participated. Notes were intended to write immediately after the observation and in some of the activities, e.g. board meeting in April 2013, it was possible to write notes during the observation. In the notes, observation and interpretation were strictly divided to make sure what was seen and what was the researcher's assumption and interpretation of the scene (Maykut and Morehouse 1994 p. 73). However, the amount of observation of both the individual work and common collaboration activities was limited due to the low number of mutual meetings and activities during the research period and non-set times of individual research work.

Observation as a research method brings other challenges that must be overcome. There is a delicate line between participation and observation, and the influence of researcher's presence of on the situation is unknown. "The qualitative researcher assumes that his or her presence will be reacted to by the participants in the setting to some extent but by assuming an unobtrusive presence the researcher minimizes this reactivity (Maykut and Morehouse 1994 p. 72). According to Stoddart (1986) becoming invisible is facilitated by participating in the on-going activities with other project participants without calling a particular attention to oneself, rather than adopting a detached position seeking objectivity.

But how much should one participate or try to fit into the setting among the participants one is studying? It is a delicate balance between being an observant and participant, and it is in the researcher's judgment to decide what it takes to understand the situation from inside out. Indeed, there is no correct answer of what is counted as pure observation. Gold (1958) provides a framework of observation stances that describe the degree to which the researcher is involved to the phenomenon under study. Closest to the case of this study is the *observer as participant* stance (Ibid. p.221), which enables the researcher to participate in the group activities as desired, yet the main role of the researcher in this stance is to collect data, and the group is aware of the researcher's observation activities (Kawulich, 2005). Indeed, to keep the researcher's influence to a minimum, the scientific researching approach was not emphasized, and the researcher aimed at acting as one co-worker in the project rather than an outside observer. Every time, when interacting with the participants, the approach was kept as natural as possible.

During the research period, a diary was maintained, where all notes from observation were documented. In addition, other important findings, keywords, interesting literature material and notes from phone conversations and other interactions in the project were added to the diary. Indeed, "a richly detailed research journal (in this context meaning a diary) becomes a useful part of the data collection and analysis process (Maykut and Morehouse 1994 p. 68-69). Furthermore, maintaining a diary is valuable since it makes the implicit research thoughts explicit (Maykut and Morehouse 1994 p. 33).

3.5 DATA ANALYSIS

Qualitative research analysis is characterized by inductive approach (Maykut and Morehouse, 1994). In this study a typical qualitative data analysis method, constant comparative method was used, which is originally initiated by Glaser and Strauss (1967). In this method, each meaningful unit of meaning is selected, compared to all other units and subsequently categorized and coded with similar units (Maykut and Morehouse, 1994).

Before the actual analysis, recorded interviews were first transcribed to text. The data analysis itself contained two rounds: inductive and deductive. In the first round inductive approach was taken, and relevant units of meanings were searched in all interviews. After all units of meaning were browsed, they were categorized into themes. First prominent coding category was chosen, next units of data were looked trough and checked if one or more data units fitted to the category. Similarly, each of the data units was compared to the coding category and other data units already categorized, to the see if they fit together. If a data unit did not fit to the category, another provisional theme category was created. All units of data were proceeded in this manner until all of them were categorized. Over the course of comparing and categorizing data units, categories and themes evolved and some of them were regrouped. If a unit of meaning fitted to several categories it was duplicated and placed to both themes. In addition, if a unit of data did not fit under any category, it was placed to miscellaneous category and later reviewed again in another round.

All findings and categories were put on a table where each of the categories was placed in a row and units of data were listed according to interviewees in different columns. Table 1 represents the analysis framework that was used to interpret the data and to group the findings.

Table 1: Categorization of the units of meaning.

	Interviewee 1	Interviewee 2	Interviewee 3	…
Theme 1	+	+	–	
Theme 2	–	–	–	
Theme 3				
…				

Observational notes from field visits and project activities were then browsed through using the same inductive approach. Each unit of meaning was checked and reviewed against found themes. The unit was added to a suitable theme if found. If none of the

themes corresponded to the unit under review, a new theme category was created. All observation and field note data was reviewed in this manner and added to the analysis framework.

In the second analysis round, the interviews and notes from observation were reread deductively remembering the themes that were found in the first round. Additional supportive units of data were looked for, and data categorizations were adjusted based on new findings. Finally, each of the themes were then analysed and checked for supportive (+) and negative (-) opinions (Maykut and Morehouse, 1994 p. 141). Figure 9 represents the process of data analysis.

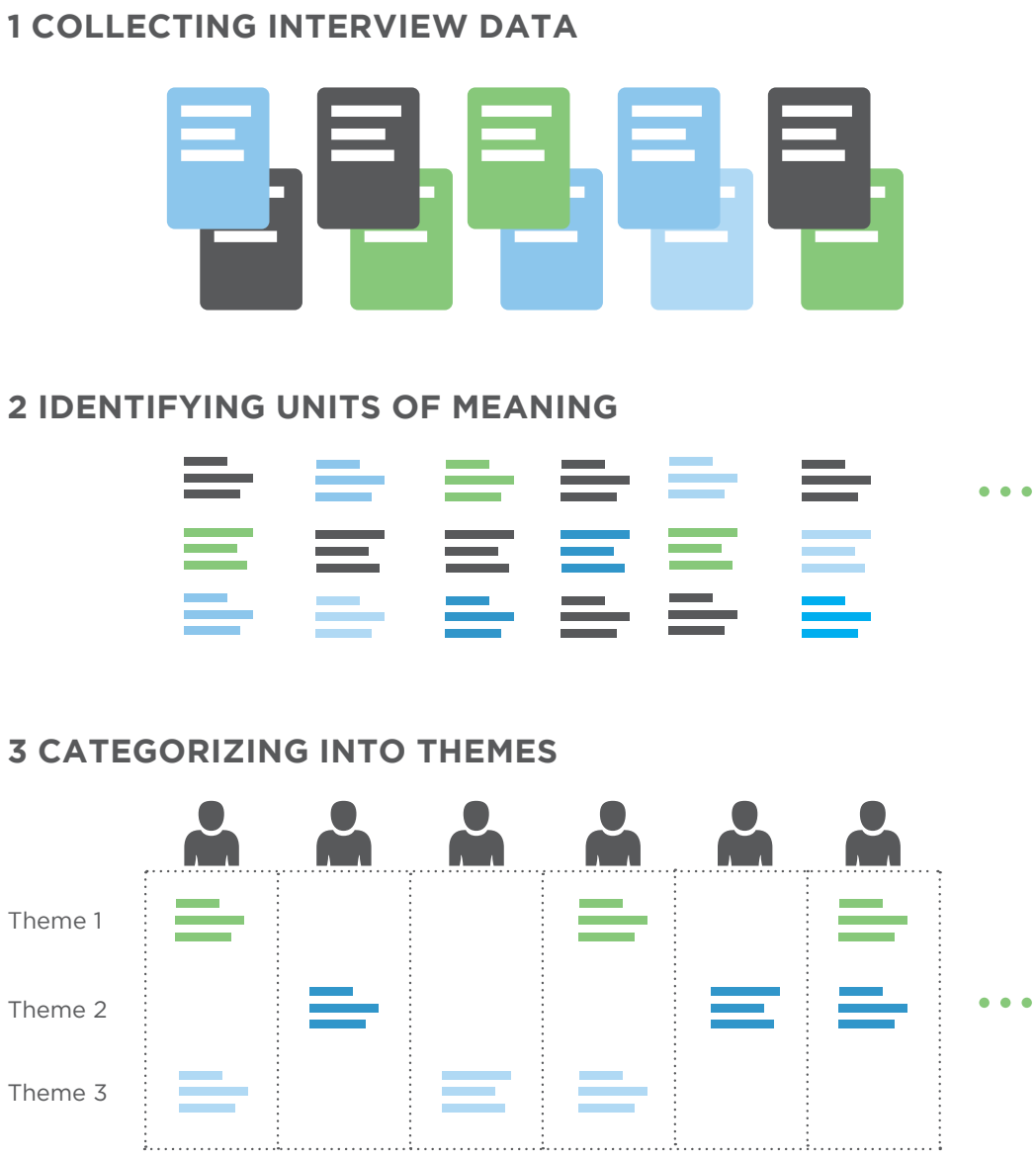

Figure 9: Process of data analysis: 1. Ten semi-structured interviews were conducted. 2. Units of meaning were identified in the interview data. 3. Units of meaning were categorized according to common themes and placed on the table.

3.6 CHALLENGES IN THE RESEARCH AND RESEARCH TRIANGULATION

Qualitative and case study research as any other research approaches, contain several challenges with regard to validity and reliability. To overcome these challenges, research triangulation often proves to be useful. Triangulation means in practice approaching the unit of analysis from several perspectives, that is, collecting data from a large range of persons and settings and using a variety of methods (Pettigrew, 1990). The purpose of research triangulation is to attain a more complete and accurate interpretation of the phenomenon (Eisenhardt, 1989; Maxwell, 1996 p. 76).

First, data was triangulated by selecting a broad range of persons to maximize possible point of views. Second, several data collection methods, i.e. interviews, observation and field reports, were used as they create complementary insights, which add richness to the data (Eisenhardt, 1989; Pettigrew, 1990). For instance, using interviews as the only method has several challenges: the questions posed in the interviews always determine to some extent the answers researchers find (Maykut and Morehouse 1994 p. 43). In addition, words and meanings can be understood and defined in many ways (Ibid. p. 19). Moreover, what people say might be different to what they actually do and think.

Third, several strategies of using multiple researchers were used. Primarily two other researchers were involved in the observation by participating project related meetings and other activities (Pettigrew, 1990). The advantage is that observations from several investigators increase confidence in the findings (Eisenhardt, 1989). In the case, two out of ten interviews were conducted in two-person teams. One researcher handled questions and other researcher remained distant making notes and asking additional questions (Eisenhardt and Bourgeuois 1988 p. 741). Regarding data collection process, the interview outline was created and reviewed together with two other researchers and in the analysis phase, the findings and themes found from the data were reviewed with two additional researchers.

Finally, a potential vulnerability of the single case design is that the case might turn out to be something else than in advance was thought (Yin 2009 p. 15). This challenge was taken into consideration by emergent and sequential research process, keeping the initial scope somewhat open and letting the insights guide the process.

4 RESULTS

In this chapter, results from the interviews and other research data are presented. As described in the previous chapter, the data was analysed inductively and categorized into conjoint themes. In total of five major categories emerged from the data, majority related to the interaction of the participants and some to management and company role. Figure 10 illustrates the categories, and the categories are presented in the following sections.

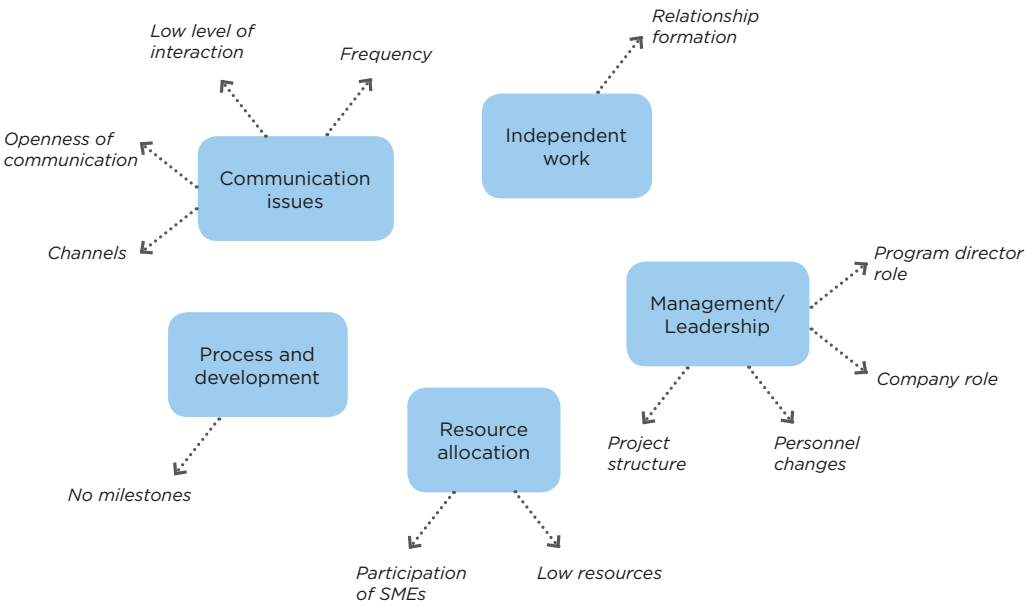

Figure 10: Five main categories emerged from the research data.

With regard to anonymity and confidentiality of the research, names of the participating organizations and participants were anonymised as follows: RO as for a research organization and CO as for a company, numbers indicating different ROs and COs. In addition, different co-location units within one research organization were marked as A and B i.e. RO1A and RO1B. Additional organizations not part of the case project were named as organization X, Y, Z etc. In addition, an outside translator was consulted in translating the citations from Finnish to English,

4.1 INDEPENDENT WORK WITHIN THE WORK PACKAGE

As a whole, research work was considered highly independent. Each research organization participant (eight interviewees) stated that the work is done individually. The tasks seem to be independent already from the beginning:

> *"We have been working in isolation or I mean alone, because the concept we are working on is somewhat different." Researcher-RO2*

Some of the interviewees said that others are not able to even contribute to the research due to the novelty or specialty of the work:

> *"We are marching to the beat of our own drum. The things we're working on are very novel and different to what others have done."* Manager-RO3

However, it is difficult to speculate whether the tasks were independent already from the start of the project or have the participants moved away from one another during the process. As one participant wonders:

> *"Thus far we have worked separately, we have not been collaborating at all and we have not even been encouraged to collaborate with others."* *Manager-RO1B*

On the other hand, the roles and areas of expertise were considered to complement each other fairly well. No specific expertise was lacking and participants' specialties did not overlap too much.

COLLABORATION PARTNER FORMATION AND RELATIONS

Often participating research organizations were in contact only with the coordinating company and lateral collaboration links were not common. Each research organization had two main partners (figure 11).

> *"Well, within the RO1 we have been working together with the RO1B [other co-location] unit and then also with the CO1, because it is the only company in our work package. In a way, collaboration towards two directions or I mean two main partners."* *Researcher-RO1A*

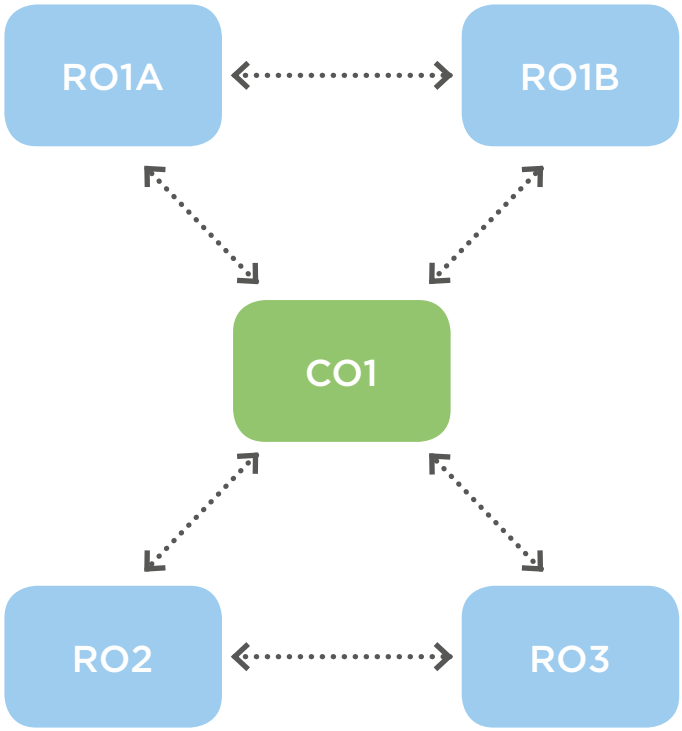

Figure 11: Each participating research organization has two main collaboration partners: the coordinating company and the closely located organization or another co-location unit within organizational barriers.

In the beginning of the project, some of the partners knew each other where as some were new to others. Four of the interviewees out of ten said that knowing or not knowing others beforehand did not effect collaboration. Some in turn stated that knowing beforehand helped them to identify people and necessary skills easing the communication.

> *"Of course, it's easier when you know somebody. It's easier to communicate and you find common ground." Manager-RO1A*

If knowing others facilitated the communication, not knowing others raised the barrier of contacting people to some interviewees.

> *"Certainly it wouldn't occur to me to write an email to someone I don't know. It's hard to contact someone if you don't even know what they do." Researcher-RO1B*

Many of the participants said that during this long project it takes time to form the relationships, to become closely knit and to find suitable ways of working especially in case where people were new to each other. However, several interviewees stated that despite the fact that SHOKs as a collaboration form are new, the relationships have improved and the collaboration is fairly good.

> *"Relationships have evolved quite a lot, if you remember that we started from square one with everyone in the beginning." Manager-RO2*

What seemed to support the partnership formation and execution were 1) previous contacts, 2) organizational links within the work package and between work packages and 3) close location as two closely located research organizations collaborated often and one research organization interacted within the organizational barriers between co-location units. Two of the research participants agreed that the close location enabled closer collaboration.

> *"The location is essential regarding the collaboration with RO3. It's easy when they are nearby." Researcher-RO2*

> *"Especially thanks to the close location, we are able to meet at short notice." Researcher-RO3*

4.2 QUALITATIVE ASPECTS OF COMMUNICATION

As a whole, interaction between participants was often formal and stiff, and no room was left to spontaneous conversation. Moreover, IPR rules reduced the openness of the communication. In addition, two other themes emerged from interacting with one another: frequency of interaction and communication channels between participants. Each of the themes is discussed in the following sections.

> *"Well, we have mainly communicated in official ways, meetings and appointments." Researcher-Ro3*

4.2.1 Low level of interaction

Communication between participants often happened in meetings. However, meetings were not considered as most productive means to have conversations. They were considered more like one-way reporting rather than two-way communication events.

> *"I don't know how others consider the executive group meetings, but in my opinion they remain as informing sessions. We don't ponder how we truly could collaborate and work together. Maybe it's because not many researchers are present there." Researcher-RO1B*

> *"The things that others do, remain quite unfamiliar because we just go there and present our own results. Like we do this and the guys at RO3 do that."Manager-RO1B*

> *"Not much interaction happened during the meetings. We just presented what each participating organization had done and then we just left." Manager-RO1B*

Moreover, the topics remained superficial, and no opportunity for in-depth conversation was left.

> *"I would hope - and it would be interesting - to go into detail or discuss more research related things [in the meetings]." Researcher-RO1A*

> *"The meetings don't offer much; it is basically presenting one's own work." Reseracher-RO2*

What reduced the possibility to conversation was the **number of participants** in the meetings, as it reduced the possibility for freeform discussion. The number of participants in meetings and the need for discussion between the work packages is however problematic. Interviewees felt that there should be more interaction with companies and research organizations from other work packages. This increases, the number of meeting attendees and reduces the possibility for freeform discussion. The interaction between work packages is discussed in more detail in the following section.

> *"The amount of people in the last meeting was way too big. Because of that you couldn't discuss any detailed things that concerned only some of the attendees." Researcher-RO3*

> *"The amount of the people you need to call for meetings is too big." Researcher-RO1A*

> *"For example, there are many open questions related to the collaboration with RO2 and RO3 that you could ask. But it isn't worth it to break down any details in that forum." Manager-RO1A*

4.2.2 Openness of the communication

Especially in the official communication, several interviewees stated the fear of openly expressing ideas and revealing accomplished research results. IPR rules and regulations were said to reduce the open interaction between participants.

> *"[IPR] clearly affects most, there are two things, either people don't have any results or results are so promising that they might be protected." Researcher-RO2*

> *"It feels that it [IPR] has slowed down the progress of the project. One cannot even discuss own ideas, because if you bring them out to the project, they become everyone's property." Reseracher-RO3*

Another assumption by the research interviewees was that companies might not want to open up their own goals in order to protect their strategic aims. The company representative in turn admitted that protecting IPR is a difficult task; one either overreacts or underestimates the importance of the information.

> *"We are a bit unsure about how interested the companies are in the project as they have not opened their own goals." Manager-RO2*

> *"Many of the topics, or let's say pain points indeed revolve around IPR. On one hand, it is often overreacting or you think that the information is more special than it really is. On another hand, you should always think that sure, I could inform you on this, I have plenty of know-how anyway. But often, corporate people are quite careful regarding IPR." Manager-CO1*

To conclude, participants feel that IPR rules decrease the openness of communication as each participant automatically gains access to the technology or information shared in the project.

The lack of openness and IPR rules also decreased the development progress according to some interviewees, as certain technologies could not be brought to the public use in the project. The coordinating company, however, was willing to make any special arrangements and workarounds if needed and stated that any special agreements were only a matter of negotiation.

> *"As far as I understand, these challenges are only a matter of discussing and it is in everyone's interest to get somewhere and of course our also company's interest." Manager-CO1*

4.2.3 Interaction frequency

Almost all respondents admitted that interaction with the research participants was not enough or happened too seldom. Low amount of communication was applied on several levels in the project: between work packages, within the work package and between the participants' personal links.

BETWEEN WORK PACKAGES

Several respondents saw synergies between work package research topics, and cooperation between wps was regarded as useful. Meetings that were common to several work packages were seen as an initiator or catalyst to the collaboration. However, up to this stage of the project, not enough effort was made to enhance collaboration. Towards the end of the project, participants hoped for more meetings.

> *"Too little. Indeed, the interaction between the two work packages has not been enough." Manager-RO2*

> *"Maybe I would hope for more joint meetings with work packages. Now we've had some, but we could have had them even earlier to initiate the collaboration between work packages. Currently the collaboration is moderate, but it might be better if we had initiating meetings earlier." Manager-CO2*

> *"I would have hoped for more horizontal collaboration and communication between work packages, similar to the CO1's meeting was. Meetings where we go through what we've done and on which areas we could work together." Manager-CO2*

COLLABORATION WITHIN THE WORK PACKAGE

Related to the independent work discussed in the section 4.1, collaboration between participants within the work package was not active either. The communication happened mainly through official meetings.

> *"Well, the meeting interval in this project has been drawn out a bit." Researcher-RO1A*

> *"We don't have any regular dialogue, the general meetings have been the main means of communication." Researcher-RO3*

A suitable amount of meetings within the work package participants was around four times a year. Meeting more often was considered too intense due to the nature of work; research process will not progress that rapidly.

> *"Once we get going, a month is a short time, you don't need any weekly meeting. Ordering reagents takes two weeks." Researcher-RO3*

In comparison, collaboration in the other work package happened frequently.

> *"We keep in touch via email if not weekly, then at least every other week. Pretty intensive. In this work package CO3 and us are the main leaders. So, the collaboration in this project is quite intensive." Manager-CO2*

PARTICIPATING ORGANIZATIONS' PERSONAL LINKS

As mentioned earlier, participating research organizations and company tend to do research independently in the project. The interaction frequency varied from a few times a year to once or twice a month. Closely located research organizations interacted

more frequently than the ones that were geographically more distant even if they were part of the same organization.

> *"We have had a lot of interaction with RO3 but not with others. For instance, neither with RO1 nor with companies except the official meetings." Researcher-RO2*

> *"The intensity varies, now we haven't had that many proper meetings, sometimes even a couple of months' break. Not really intensively, occasionally more often. Sometimes not that often. Not weekly." Manager-RO1B*

Communicating more often was seen beneficial and useful, but a reason for meeting was important. A clear link or problem has to exist.

> *"Of course there needs to be something in common in order for it [the meeting] to make sense. Otherwise it is general jargon." Researcher-RO2*

> *"If we just have a reason for it [the meeting]. There needs to be a point in having the meeting." Reseracher-RO3*

These differing opinions create a dilemma; participants would like to interact more, but clear link and reason for meeting needs to exist in order the meeting to be useful. As participants do not feel self-guiding, it is in the coordinator's responsibility to call for meetings and to encourage different parties to interact. As one researcher says:

> *"The coordinator of our work package or any other of the leading roles would say that you two could collaborate. Then, I guess that would motivate people to look for things in common." Researcher-RO1B*

With regard to time allocation, project participants feel that they are able to meet more often, the time and a date need to be agreed well in advance.

> *"So, yes I could see that. People can attend [meetings], if the time and date is given early enough. Sure people have time." Manager-RO1A*

4.2.4 Communication channels

Communication channels varied between participants. Official communication with all project participants happened through meetings. In addition, information was exchanged through a designated online portal. For personal contacts, phone and email were used. Two closely located research organizations were able to meet regularly face-to-face. One research organization used video conferencing to communicate between co-location units.

In comparison, the representative of another company and participant of the other work package described the communication within the work package to be flexible and diverse. Several ways of communicating have been used in need.

"All in all, the meeting internally in the project has been very flexible. We have had a meeting every time there has been a need for it or we have felt that we need to discuss. Or an email meeting, depending on the breadth of the problem. Pretty versatile practices, I think. Or one-to-one phone conversations, going through an issue, the status, next steps and so on. On a grand scale, I'd say." Manager-CO2

FACE-TO-FACE COMMUNICATION

Eight interviewees out of ten said that communicating face-to-face is beneficial, and it was seen as the most effective way to interact compared to any other communication channels.

"Basically, explaining something or expressing yourself face-to-face is always more helpful." Researcher-RO2

"Indeed, I think communicating face-to-face is a lot more productive." Researcher-RO1A

"I feel it's maybe more efficient and I prefer it [communicating face-to-face] to sending emails back and forth. I think that interacting in person is indeed more productive and makes things come along as opposed to communicating using digital tools." Manager-RO1B

ONLINE COMMUNICATION

In addition to low level of communication face-to-face, online project portal was not widely used either. Four interviewees did not have user credentials to the portal and four interviewees had used it seldom. The latter ones were responsible managers who uploaded official documents and reports to the portal. Two of the interviewees said that the portal was not user friendly. It can be concluded that communication did not happen through the portal, and it was mainly used for storing information.

COMMUNICATION BETWEEN RESEARCHERS

Particularly, project researchers did not communicate much with each other. Information was often exchanged in formal meetings, which were open to every one in the project. No smaller scale practical meetings were arranged. Researchers hoped however that their role in the project would be more participative. In total of five interviewees suggested researcher meetings where topics are practical and the number of attendees is limited. Indeed, laboratories are the places where the actual project work is done.

"The lab is where the real work is done. And to combine the results, us researchers should be aware of what other researchers do, so that we could collaborate. " Researcher-RO1B

In comparison, researchers' involvement differed in the other work package. In the company representative's opinion the communication was good and ways of meeting diverse. The scale of meetings varied from minimum two participants to several, and the communication was active using various channels, email, phone etc.

4.3 RESOURCE ALLOCATION

PARTICIPATION OF SMALL AND MEDIUM SIZED COMPANIES

Based on the interview data, investing money for a project is easier for large pharmaceutical companies as opposed to small and medium sized companies (SMEs). The investment can cover up to 10 per cent of SMEs' budget, so the decision to participate the project or not is rather important, and the investment with following risks is relatively high to SMEs.

> *"It's a huge investment for an organization. We have a fixed amount of people working in the R&D. And working on IMO is out of our own product development. In this regard, it's a huge investment, although moneywise we're not a big company in this project. Nonetheless, if 10 per cent from a small company's R&D budget like ours goes to IMO, that's quite a considerable investment for the company." Manager-CO2*

> *Thinking of a small company or SME sector in general with fewer employees, it requires a deep commitment to the project. In practice what it means is that if a company that wants to be part of the project, the minimum investment is 100k euros per year. That is equivalent to one researcher, traveling, equipment and resources; it can be a lot of money for a company especially for a start-up. And then, if we talk about a bigger company, 500-800k euros of investment money for a project, that's a lot of money. And of course you keep track of that project and make sure that it will yield good results, because companies make their living from the profits of the products they produce." Manager-CO1*

LOW RESOURCES

Only participants with 0,5 annual working unit allocation mentioned the challenge of low resources during the interviews. That is, a person working full-time for six months during one year. Low resources affected also the ones that worked closely with the mentioned research organization. Although own resources would have been enough make progress in the research, co-workers caused delays in the process.

> *"It's dependent on the funding. The guys, with whom we collaborate, have only a half annual working unit at their disposal. So, when the resources run out, we too have to stop working for six months."*
> *Manager-RO3*

Small resources made the research also more straightforward and left no chance for opportunistic experiments:

> *"We have to focus and optimize our work so much that it's like taking the path of least resistance. Or, we just try to find something that works to make at least something happen. There's no time to test something new."*
> *Researcher-RO2*

4.4 PROCESS AND PROJECT SCOPE

In terms of process, no clear milestones or reviews were identified in the project to keep track on the progress. Only one participating research organization had their internal milestone plan created in order to be able to stay in schedule. However, several interviewees stated that this type of a plan is not needed. Work was considered so straightforward that there was no need to divide it into shorter subprojects.

Despite the lack of a milestone plan, the scope of the project was changed in the half way of the programme. Reason for this was the strategic decision by the coordinating company. It clearly stated its willingness to concentrate on another technology development during the latter part of the project.

MEETINGS AS INTERACTION POINTS

As mentioned earlier, some of the respondents expressed their wish for more meetings. Meetings were regarded as a means to keep attached to the project and to create a sense of urgency to progress in the research. Meetings created deadlines to the work; something had to be done by the time project participants met, regardless of level of the results.

> *"Regular project meetings are deadlines, by that time I need to have the results ready, regardless of does it work or not. We haven't had that many internal meetings either, maybe we'd better have them, because they form deadlines to finish things by that time." Researcher-RO1B*

> *"Yes, it [meeting] is necessary to remain in contact with the project." Researcher-RO3*

APPLIED RESEARCH

All research organization respondents stated that the research in the project should be applied rather than basic to be in line with their organizations' vision. In addition, several respondents hoped that their work would be meaningful and seen as beneficial from the companies' perspective. These results suggest that the anticipated challenges of universities conducting applied research (Lukkari 2013) would not be an issue in this case.

> *"Application is the thing, we don't just want to do basic research." Manager-RO3*

> *"It's in our organization's values to support Finnish enterprise. In this regard, it would be of course good to do research that has relevance to the company." Researcher-RO1B*

However, perspectives on the characteristics of the research in the case project differed. Some of the interviewees considered the project to be close to basic research where as some saw it as applied or even leaning towards product development. Nevertheless, none of the research participants saw applied research as a disadvantage.

SCOPE AND BENEFITS OF THE PROJECT

Research organization participants saw the project as an avenue to publish articles and to enhance their area of expertise. Benefits for the companies were new product and technology concepts leading into potential products in the future. In addition, both parties saw SHOKs as a potential platform to create new contacts and to form new partnerships. For research organizations, SHOK model was considered as an important financing instrument. Staying part in the cluster was a success itself.

> *"Maybe, being part of the second phase is already a success per se. This is coming along I mean, because this [project] gives us good resources." Manager-RO3*

> *"We need to stay a part of the IMO concept." Reseracher-RO2*

> *I could see that networking is one of the most important things and a value per se… And as we aim to develop new production systems, maintaining the collaboration with other work packages is a priority. And it takes a lot of effort from companies to maintain the contacts and keep themselves updated in regard to the project progress and how the research organizations are progressing. Because if companies don't stay active, the research organizations will soon start working on things that are more natural to them, i.e. research and scientific publishing." Manager-CO1*

As both parties have different personal goals, they should nonetheless strive for a common target (Khanna, Gulati and Nohria, 1998). As several interviewees argue that being able to stay in the project is already a win per se, it can be concluded that participating organizations were aiming at successful collaboration.

> *"There should be a clear target, i.e. "we do this because of X". It doesn't matter if it's a product or an innovation or whatever as long as it's a clear goal. It could be reachable in three, five of even ten years. As long as the goal is clear and we know where we're heading. And to reach that goal, we need to do this research. … This is linked pretty well to the planning of the new programme, because what our board wants is a better vision on what the future product is at the end of the programme. What will the actual ROI [return on investment] be? That is, we live in a corporate world. There needs to be a vision of the effort we put in a project: these are the concepts, these are the ones that will be future products, on which time span they will turn in profit." Manager-CO2*

New partnerships and collaboration were regarded as an intangible benefit of the project.

> *"What we have gained from this project is that earlier we had not collaborated much with company X. Clearly, thanks to SHOK and IMO our collaboration has increased as opposed to what it would be without IMO." Manager-CO2*

4.5 MANAGERIAL ASPECTS OF THE PROJECT

PROJECT STRUCTURE

All interviewees had experience in national and/or international collaborative research projects. This case project was not considered as rigid or byrocratic as other EU level collaborations. In addition, one interviewee felt that the health and wellbeing cluster functioned better compared to other SHOK clusters. Small size of the cluster and the collaboration experience of the participants might further assist managing the project and the cluster as a whole.

CHANGES IN THE PERSONNEL AND PARTICIPATING ORGANIZATIONS

What was particular in the case was that during the project several personnel changes occurred. Coordinator of the project (representative of the company) and two managers in the Aalto Design Factory were changed during the early phase of the project. How it seemed to have affected the project is that it reduced the progress as new persons had to get on board and familiarize themselves with the project. In addition, two companies and one research organization, originally taking part in the collaboration, withdrawn from the project.

THE ROLE OF PROGRAMME DIRECTOR

Several interviewees highlighted the importance of and the role of the programme director, although the person was not part of the day-to-day project operations. The director was in charge of the early launch of the project as well as financial and research report submissions.

> *"Top management, meaning the programme director, works precisely and rigorously and you always get good instructions for reporting. The instructions come in good time and the person will even send a reminder." Manager-RO2*

> *"Financial reporting is taken care of really well." Manager-RO1B*

> *"I think it [top management] has worked really well, reporting and all that. All credit to the programme director. Without this person, this project would not work at all and that's a fact. Or it would have worked a lot worse, particularly the general management. This person has taken care of when to report, has sent report templates and schedules. This project is quite huge after all when it comes down to the number of participants and the budget." Manager-CO2*

COMPANY AS A LEADER AND COORDINATOR IN THE WORK PACKAGE

Some interviewees speculated that the role and responsibilities of the companies were not clear in the project.

> *"Maybe their [companies'] objectives are not clear, for instance, what is it what they want out of SalWe." Researcher-RO1B*

How it might have shown in the project was the lack of feedback and guidelines. Indeed, if the scope is to create new products in the longer run, it is in the company's responsibility to be active and guide the process.

> *"How this kind of collaboration or refining it towards more production or product friendly direction rides on company's activity." Manager-CO1*

Moreover, research participants especially hoped for more feedback and firm sense of research need.

> *"In a way I would have hoped for more feedback. They could have told us what they want us to do, because the project is so clearly turned towards products." Reseracher-RO3*

The leader role was strongly institutionalized in the coordinator of the work package. The person was expected to call for meetings and send reminders to submit reports. In addition, this person was supposed to actively encourage participants to meet each other.

> *"Nothing happens if you don't say it out loud. The daily routines run pretty fast while doing your own thing. [Contacting others] is easily forgotten, when everyone is struggling with own challenges." Researcher-RO1B*

> *"How could I say this, the project is... the project activities are not very rigorously managed." Manager-RO1B*

What was challenging in this particular resource instrument was the changed form of the project model. Earlier in nationally funded research projects, research organizations were the driving forces initiating the research offering skills and expertise to companies. In the SHOK model the setting was opposite. The companies ought to drive the scope of the research and assign suitable research organizations to execute the research. As the manager of a company states:

> *"This first programme has been a learning experience for me. Even more clearly I have learned that I must guide the research. Being a researcher for long time myself I know that we tend to take a step aside from what we were supposed to do if we find something interesting. You just have to set limits, that no matter how interesting it is, it's not part of the programme." Manager-CO2*

> *"There is such a great opportunity to dictate the content of the programme. This present programme is a kind of in between and the new programme will clearly take a step forward. The companies really will determine that this is what we want and you and you and you are the ones that will make it happen." Manager-CO2*

> *"I think that it was particularly a matter of not realizing it in the end. Realizing that you can say it out loud and put your foot down: "I want this to be done and you will make it happen". I think the biggest problem was not to realize that, or at least I didn't internalize and I don't think other companies either had a clear picture in mind what is all was about." Manager-CO2*

This change in the project model seemed to have caused the confusion in the project roles and responsibilities. One of the company representatives admitted that indeed the companies did not internalize the swap of the leadership, and thus were not able to exploit the project to full potential. Opening up company strategies and guiding the research was not however a problem to the companies, only the position was new. Indeed, the freedom to say what is to be investigated was considered important.

> *"For me it's ok, and actually this is something the companies need to do. It is misspent resources if you don't guide and control the work. There's no sense in that, it would be insane." Manager-CO2*

5 DISCUSSION

Five main themes, emerged from the research data, are discussed and analysed in this chapter. Results are reviewed against the findings from literature, and meanings to and possible reasons for the phenomena are discussed. The analysis is followed then by a list of practical implications that could be executed during the project existence and in future SHOK collaborations.

5.1 THEORETICAL IMPLICATIONS

INDEPENDENT WORK

Starting from one of the major insights, work within the project was fairly independent. Several interviewees admitted that they were working alone on their research area, although at the same time, many of them stated that the work was well divided into concrete tasks for each participating organizations. The tasks and expertise areas were so far from each other that other participants could not even contribute to the work according to some interviewees. As said, it is difficult to speculate was the work independent due to the task division or the project management. For the success of the project, participant selection is one of the most crucial factors. In this case, it seems that the participants were well selected, each of them bringing complementary expertise to the project. However, participants were not actively encouraged to collaborate more. As Lynch (1990) notes, the more differentiated the participants are, the more effort to the integration should be made. Otherwise the synergy and focus of the project might be lost. More active coordination and encouragement to collaborate might increase the effectiveness of the project still during its existence.

In addition, as academic and private organizations were part of the project, possible cultural differences were expected to cause challenges (Barnes, Pashby and Gibbons, 2006). However, results of the data did not show any indication of this factor. No major contradictions or different ways of working between private and academic organizations were noticed. Differences between academia and industry limited only to varying project goals. Nonetheless, challenges related to cultural differences can be facilitated by effective project management (ibid).

There are several factors that might have caused the project work to remain independent. As noticed in the interview data, half of the interviewees said that knowing others in advance would ease and not knowing other project participants might raise the barrier to make the first contact. Especially, if the work remains independent, contacting and interacting with others might require even more effort. Furthermore, two of the participants who joined the project after the launch, said that they were hardly in any contact with other project participants except the main collaboration partners (closely located or within one organization). It could be concluded that not knowing others is either neutral factor or has a negative effect. To avoid this situation, the barrier to contacting people should be diminished to as low as possible by organizing activities at the start to meet all participants, and to provide all contact details throughout the project.

However, not knowing others can also be an advantage, especially with regard to project outcomes. Forming partnerships only with known people might lead to a situation where the opinions are too unified and several project aspects might be taken for granted and not worth discussing. This is in line with Bor and Boersma (2010) who found out that forming projects with similar and like-minded colleagues seems a good strategy at first but it creates unintended false impressions on project procedures.

Additionally, R&D phase and medical device development might have set specific characteristics to the project. In other words, as research relies heavily on the use of high technology equipment located in participating organizations' premises, naturally, majority of the actual research work in done independently and remotely. Sharing and communicating the progress made and knowledge created become then a key issue in the case.

DISPERSED PARTICIPANTS

Another aspect that seems to affect the project independency and low integration is the geographically dispersed location of the organizations. Although collaborating with others seems to be common in this industry, geographically dispersed locations tend to reduce the amount of interaction. That is, close location naturally enhances collaboration, where as on the other extreme, spontaneous and serendipitous interactions do not happen due to geographically long distance, and reason for contacting and meeting others has to be strong. In the beginning of the project, locations of all participating companies could be mapped and enough interaction activities to reduce the remote collaboration factor could be planned.

Although majority of the participants agreed on the effectiveness of face-to-face communication, the geographical diversity sets challenges to interacting effectively. Hence, considerations on using online communication tools could be attempted. However, inter-organizational context might create special challenges, as additional online communication tools need to be set up across organizational barriers.

MENTAL MODELS

Although coming from different organizations, participants form a temporary team around the project. The challenge in these kinds of projects is that each participant comes from different individual and shared mental model, although from the learning perspective it would be crucial to create shared mental models with the project participants (Kim, 1993). Especially in inter-organizational context as participants come might from even more differentiated backgrounds, creating shared mental models might be even more essential for the project success. By creating a shared mental model, the temporary team forms a shared understanding of what is valuable and which actions to take. At the other extreme, "when the link between individual mental models and shared mental models is broken, fragmented learning occurs" i.e. individual learns but the organization as a whole does not (Kim 1993 p. 46). Highly decentralized organizations that do not have networking capabilities to keep parts connected are vulnerable to fragmented learning. To overcome fragmented learning and to expand shared meaning in an organization, it is important to make individual mental models explicit and share them actively. This thought supports active meeting

habits and communication between project participants. Thus, enhanced interaction and an intense collaboration especially in the beginning of the project is recommended.

Although group level is not explicitly included in Kim's model, he argues that if groups are seen as a mini-organization whose members contribute to the group's shared mental models, his framework represents group learning process as well. Indeed, a group can be seen as a collective individual. This thought is in line with Walton and Hackman, who claim that organizational structure and type of management style affect the groups' performance (1986).

MODES OF KNOWLEDGE CONVERSION

Nonaka and Takeuchi provide framework to approach the results from knowledge creation perspective. In this case, knowledge was externalized from implicit to explicit (Nonaka and Takeuchi, 1995) in the form of slides and presentations and was transferred to other participants during official meetings. However, due to the format of the meetings, it remains unknown if receivers internalized the knowledge properly as there was not proper possibility for follow-up questions. As Nonaka and Takeuchi argue, the chance of discussing the topic and asking details improves the externalization between individuals (Ibid.).

Combination of explicit bodies of knowledge occurred also in meetings as different participants presented their recent work in explicit format. How the knowledge was stored into a system remains, however, unknown. The online portal partly worked as a storing system, but the user interface and accessibility were inadequate. In addition, mutual knowledge creation from tacit to tacit was barely existent, as participants mainly gathered together for official non-interactive meetings.

What might support the project is to diversify communication and interaction. To improve the communication one could apply Nonaka and Takeuchi's framework and concentrate on facilitating systematically all four modes of knowledge conversion. This suggestion is supported by Feller et al. as they suggest a wide variety of communication practices and even emphasize the importance of social nature of learning (Feller, Parhankangas, Smeds and Jaatinen, 2013). A failure to provide one of the four knowledge conversion processes might hinder the learning. Especially socialization and externalization practices play a major role in spreading newly internalized tacit knowledge across organizational barriers. (ibid.) Another point of view discusses that socialization and lively interaction between team members are beneficial for the performance where as knowledge sharing, i.e. externalization in the meaning of sharing knowledge outside the team boundaries, might not contribute to team's performance as it takes resources from the actual work (Janhonen and Johanson, 2011). In this kind of a situation, the use of an external body, e.g. ADF could prove to be effective, to share the resources used for communication activities.

As stated, what seems to be particular and challenging in this project were the dispersed locations of the participating organizations. As the actual synchronous communication was rare, the meetings should be designed more effectively and exploit the occasions when all participants are present and are able to communicate face-to-face. In addition, meeting follow-ups should be designed more effectively. Pre-agreed

smaller scale meetings and opportunities for additional sessions for themes that rose from the official meeting could be added to the agenda. There are implications that improving social connectedness between team members of a distributed design team could be a key to better design team performance. (Larsson, 2007) In addition, as Nonaka and Takeuchi state, knowledge creation is always a social process. Furthermore, what would be interesting to test is a more involved ADF role as a facilitator. Indeed, Eneberg has researched the role of the designer in the development process and suggests that designer could visually facilitate the iteration between tacit and explicit knowledge (2012). "Externalization of knowledge occurs when the designer facilitates an integration of different stakeholders in a process with the help of visualization skills (Eneberg, 2012 p. 464). Eneberg's insights are in line with the ADF original role in the project, and the role could be further emphasized during the project.

With regard to combination mode and the distant location, another type of online portal could be designed. However, as several researchers argue, true collaboration and trust is formed through face-to-face interaction, and the amount of direct communication should be increased in the project. Indeed, many respondents stated that the face-to-face interaction is the most effective way to communicate and discuss the research work. Thus, the online portal should not substitute other forms of communication, instead it should be used to processes where it is most suitable.

SCOPE AND GOALS

Differences between academic and company participants were mostly seen in different aims and benefits of the project. Although both parties have different personal goals, they should nonetheless strive for a common target. Huge gap between private and common benefit may indeed result in tensions in the collaboration, increase the racing behaviour and affect the amount of resource allocation (Khanna, Gulati and Nohria, 1998). As several interviewees argued, being able to stay in the project is already a benefit per se, it can be concluded that participants are aiming at successful collaboration to a certain degree.

The issue of private and common benefits leads back to the discussion on the ultimate goal of the project and the actions supporting it. Success, seen from collaboration perspective, is a highly subjective term, and opinions on success vary among participants (Davenport, Davies and Grimes, 1999; Barnes, Pashby and Gibbons, 2002). If the goal of a project cannot be clearly articulated, measuring the goal achievement in terms of metrics is difficult to set, resulting in a challenge to articulate the project benefits. Results indicate that there were both tangible and intangible benefits in the SHOK collaboration. Indeed, the immaterial benefits of the project might be as important as the concrete outcomes of the project, and these values can be measured in certain metrics.

Literature suggests various ways to measure the value. Krebs (2013) introduces three types of values created by communities of practice: structural – e.g. the creation of connections in a network or the flow of knowledge between network members, relational – the maintenance of connections or the degree of reciprocity in network interactions and cognitive value – the commonality or cohesiveness of the network. In addition, Vuolle, Lönnqvist and Meer (2009) argue that both intangible input and

output factors are significant to R&D projects. The challenge is however, the difficulty in identifying and measuring the output of R&D projects due to the intangibility of the result and the time lag between the projects and outcomes. Nevertheless, in line with the CO2 manager's comment, in order to articulate the intangible benefits one needs to clarify what are the investment objectives and how the intangible outputs will be utilized in the future i.e. what is the further scope of the R&D. (Ibid.)

It could be hypothesized the goal of SHOK projects to be two-fold: to form and to enhance collaboration between participants in the industry and to create concrete products and service concepts. Two-fold goal can be however difficult to implement, as achieving different goals are measured by different metrics, and are supported by different project models and ways of working. If the aim of the projects is to build an ecosystem, the projects should be formed and more accurately measured through forming contacts and partnerships. If the clusters aim at creating new products, current methods of collaborating might not be most suitable. Furthermore, the leader of the project majorly affects the emphasis of the scope. If the project leans more towards creating innovations, a project governance model lead by companies should be continued.

IPR RULES

As noted from the results, IPR rules reduced the project progress. There is no common agreement in the literature, how the IPR rules and financial aspects should be organized. Several scholars, however, note that these rules should be agreed in advance (Dodgson 1993, von Stamm 2003). Indeed, in the case, the ownership of the results was agreed up-front and rules were regarded as fair. Several scholars have noted the situation followed: the dilemma of trying to learn and trying to project own core know-how. As everything brought to the project was accessible for all, participants were afraid to present any emerging results that might reveal too much confidential know-how or core competence of the organization. This was said to majorly affect the openness of the communication. Nonetheless, the open policy of sharing is often best and the fairest approach, as by openly sharing valuable material and results with others would result in more innovative outcomes. The fear of someone being selfish and benefitting from the situation more than others is a natural human reaction, though not beneficial to the collaboration. Forming trust and active interaction among participants might enhance sharing and might overcome the fear of losing own proprietary knowledge and uneven sharing of the project benefits.

PROJECT NETWORK MODEL

Regarding the project governance model, the respondents considered the case project less bureaucratic than average EU level projects. It could be concluded that the project did not require much administrative work or reporting to the top management of the programme. Reason for the fairly effortless coordination might be the small size of the health and wellbeing cluster compared to other SHOK clusters. Added to the project governance model, many behavioural factors can further decrease the need of structural and organizational elements. For example, high level of trust partly substitutes the official contract between partners (Ingham and Mothe 1998). Indeed,

different forms of project governance can be referred to flat and flexible or hierarchical organizations (Pisano and Verganti, 2011).

Additionally, approaching the collaboration from network perspective, the case project model was not extremely active. Indeed, there is some evidence (Bor and Boersma, 2010) that active network model where all participants interact with each other seems to support innovation creation. In this model, all participants communicate with each other and simultaneously contribute to the same topic where as in start model, contribution is more on the coordinator's responsibility.

MANAGEMENT ASPECTS

What particularly seemed to affect the collaboration was the change of management responsibility from research organizations to private companies. Results from the interview data show that companies did not fully understand and exploit the opportunity to lead the research work and be in charge of the project. Furthermore, this challenge might apply to several projects within IMO-programme as both company interviewees representing two different projects, admitted the same problem. How this was noted in the daily activity was the low amount of feedback and guidance in the research work. Thus far, scientific research does not offer any firm opinions on the influence on company or research organization being a leader. The leadership choice might affect the emphasis on the project scope: companies leading the projects might better result in creating successful businesses, where as research organizations as leaders tend to focus more on exploring new scientific areas. The situation where companies are leaders might be challenging though, as some companies might be afraid of revealing confidential information or opening up their strategies. Nonetheless, any major changes in the project model and management roles require time for the participants to adapt to the new situation, and full project performance cannot be expected.

Additionally, two individual management roles were identified in the project: programme director in strategic role and project coordinator in operative role. Several interviewees highlighted the need for a programme director, and this person was regarded as important linking the project with the programme administration. Project coordinator was in the operative role, managing and supporting day-to-day activities. Indeed, literature suggests the need of both, a collaboration champion and the project manager. In addition, the role of the programme director is emphasized in the initial SHOK evaluation report (Lähteenmäki-Smith et al., 2011 p. 48). This role would be highly strategic ensuring commitment, providing inspiration and keeping in contact with top management. In the project coordinator role, some challenges were however, identified. The person was changed during the project, and due to the small number of companies, coordination duties were accumulated to one person's responsibility. Resources needed for coordinating the project and maintaining own work together might be too much.

Despite the specific challenges in the project, the project coordinator role should yet to be further emphasized during the existence of the project. In addition to managerial activities, the role is significant in creating a culture of collaboration (Knudsen, 2009). Without the benefit of a culture that recognizes, encourages and rewards knowledge

sharing, efficient knowledge transformation will not occur (Wu and Yezhou, 2011). This is in line with the findings that interaction will not occur if there is not active encouragement to contact one another. It is in the coordinator's responsibility to be the catalyst for interactions.

Some notions of iterative development with regard to innovative process were identified, as the project scope was changed over the course of the project. Other milestones were not identified. On the other hand, some interviewees argued that there was not even a need for them, referring to the straightforward nature of the project. There are implications that the actual level of innovativeness in project activities does not correspond to the associations to and expectations on the innovativeness in the project. As one participant states: "*This is ordinary project management among others, nothing spectacular.*" Nevertheless, the level of innovativeness – low of high - does not exclude the need for lively interaction in the project. As said, meetings were considered as a means keep attached to the project. Moreover, in line with Eneberg (2012), meetings punctuate the process and create a sense of urgency.

To summarize, the characteristics of the project were as follows: geographically far located participants, individual work and no strict guidelines nor feedback. To form an integrated project team, participants of the project need to develop a shared mental model for the project. With regard to activities, the project is kind of a temporary mini-organization that needs a right set of management activities and supporting ways of working. In order to be capable of learning and taking action, organization needs individuals to create interconnections to form shared mental model (Kim 1993 p. 45).

As a whole, one can argue that the SHOK format did not meet the expectations since the project governance i.e. organization was new and the people working together were partly new to others. Moreover, the output of the project has not been articulated in detail, which might be due to the new format of the collaboration. In other words, too many crucial modifications seemed have occurred at the same time.

To conclude, active communication seems to support the development of shared mental models with regard to learning, and conversely the change of project model would increase the need for communication. In addition, Nonaka and Takeuchi's four modes of knowledge conversion could be implemented in the project to ensure diverse knowledge creation and learning mechanisms. In the next section, several practical implications to support the project are presented.

5.2 PRACTICAL IMPLICATIONS AND GUIDELINES FOR FUTURE

In this chapter, practical implications to the project are presented. These recommended activities are based on the findings from literature review and the analysis of the research data. The common determinant to the activities is clear goal setting and reduction of communication and collaboration barriers to a minimum. In addition, collaborative learning is enhanced through these activities (Child, 2001). The key issue is to amplify individual knowledge creation and learning to other participants and to enhance collaboration between participants. This enhancement can be done by offering

several interaction points and activities to punctuate the on-going process. Majority of the proposed activities can be done already during the project existence and the emphasis is on the issues that can be affected e.g. interaction, operative management and outcome.

In addition to the process phase, much of the work for strategic collaborations is done also in the planning and kick-off phase of the project. Indeed, formation phase constitutes to one of the crucial areas in the collaboration performance. Thus, some of the activities are suggested to be implemented in the future strategic collaborations referring to the third research goal in this study.

ARRANGE RESEARCHER MEETINGS

Several researchers longed for a possibility to communicate on concrete research work. Thus, meetings for researchers should be arranged. This meeting would act as a forum to discuss practical challenges in research. The number of attendees should be limited to ensure freeform discussion.

DESIGN MORE EFFECTIVE MEETING PROCEDURE

To enhance different knowledge conversions i.e. knowledge externalization and knowledge socialization, the meeting procedure could be altered (figure 12). First, all meetings should follow a similar procedure. The material should be sent to participants in advance in order to familiarize with it before the meeting. The participants should be encouraged to openly present challenges and successes in their research. Specific goals should be set before the meeting so that the target of and the reason for interacting is clear and that the accomplishment of the goals could be reviewed after the meeting. Before the meeting, a person should be nominated for note taking to capture emerging collaboration ideas and tasks. Based on the notes, a detailed task list should be created indicating the task itself, the responsible person and next concrete action steps. After the meeting, additional material and meeting minutes and tasks should be sent to all participants.

Figure 12: The meeting procedure of the project meetings.

In addition, to solve the contradiction of high number of meeting attendees and the need for free-form discussion, a possibility to one-to-one discussions after the official meetings should be provided. As many interviewees stated, large meetings were not suitable for detailed discussion, as these kinds of events tend to result in presenting information rather than interacting with one another. Moreover, as the number of face-to-face meetings was fairly low, these opportunities should be exploited to full potential.

FOLLOW UP AND REVIEW ON TASKS

After every meeting, regardless of the type, a detailed task list should be created and sent to all participants. Facilitator or the coordinator of the project should actively follow up on the tasks and review their status and progress.

ORGANIZE MEETINGS TO PUNCTUATE THE PROCESS AND AGREE ON THEM IN ADVANCE

As the development work is iterative, annual meetings could be used as check points and reviews of the progress. Check points create a sense of urgency to the every-day work and meetings would work as deadlines to make achievements in the research. A short review of the progress could be done and targets for the next period could be set. One period could last one quarter i.e. three months (see figure 13).

As the interaction in the project has not been highly active, meetings could be agreed in advance to ensure a certain amount of annual meeting opportunities. Setting them in advance most likely diminishes the chance of delays or skips. Especially meetings concerning a single work package and several work packages should be agreed and marked to the annual calendar. Deriving from the wishes from the participants, a suitable number of meetings could be four per annum.

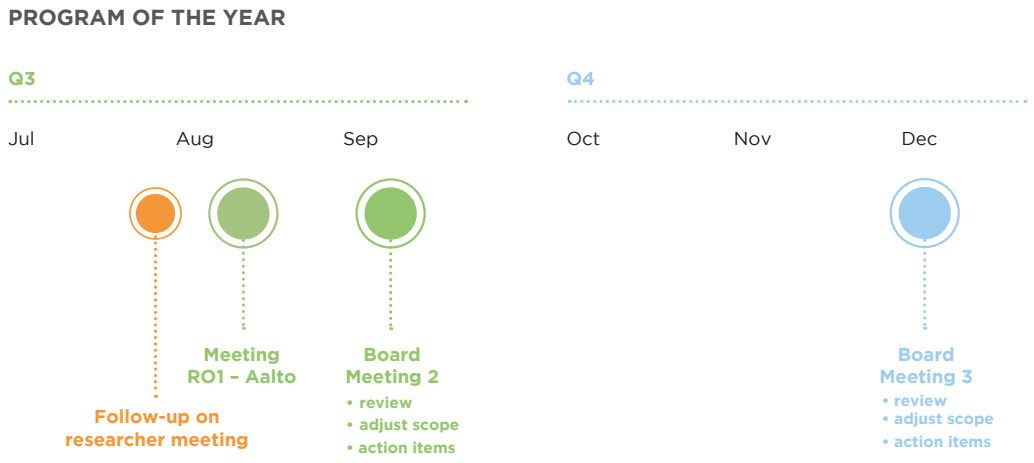

Figure 13: Annual calendar of the project.

CLARIFY ROLES, RESPONSIBILITIES AND GOALS OF THE PROJECT

Defining goals to the project is essential. Although SHOKs' focus is on R&D, outcomes in the long term are future products and services. Moreover, as the projects are formed based on private sector needs, the business potential of the project outcomes should be emphasized. Thus, research need, procedures and activities to achieve the outcomes of the project should be articulated more clearly.

In addition, the goals of the SHOKs could be two-fold: first, future services and products are developed and second, SHOKs will create new type of collaboration and initiate new relationships in the industry.

Furthermore, managing role of private companies as in giving feedback and guiding research should be clarified. On individual managerial level, coordinator of the project should be given enough resources and time aside from own duties to manage the project.

REVIEW PARTICIPANTS' LOCATION AND EARLIER CONTACTS

In the formation phase of the collaboration, participants' earlier contacts and locations should be reviewed. This activity is to seek characteristics of the collaboration so that managers can take timely action before challenges related to unfamiliarity and dispersed location of participants emerge. The more differentiated participants are, the more relationship building and trust forming should be done in the starting point of the project.

PROJECT KICK-OFF

To enhance trust formation and to form the foundation of the collaboration, a project could start by a special kick-off event to introduce all participants and to set expectations to the project. Kick-off could be a two-day seminar including several activities. These activities would enhance collaboration by improving trust formation and lowering the barrier of contacting other participants. This kick-off event would especially diminish the influence of unknown project participants and distant locations discussed in the previous activity.

VISUALIZE PROJECT PARTICIPANTS

Especially in the beginning of the project, a visual participant map (figure 14) indicating each participating employee in the project with their names, background, main work duties and contact details, could prove to be useful. The map would help employees to get to know to others and would enable contacting right people for right task. Moreover, the map would help new employees joining the project at later stage to get to know other research participants and to know who to contact.

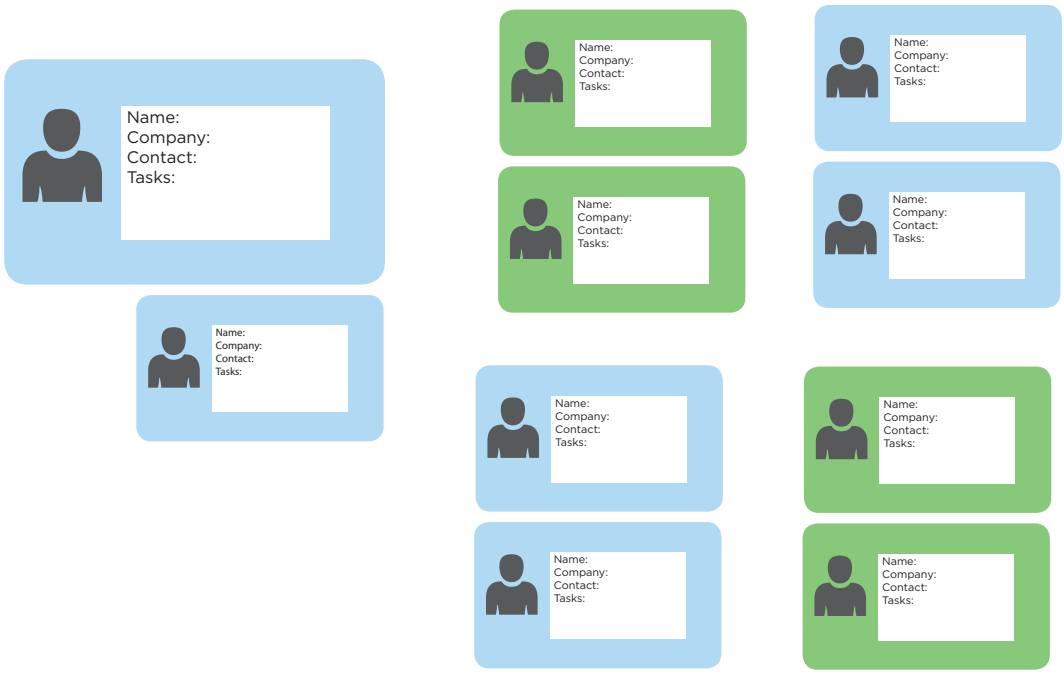

Figure 14: Visual participant map for the project.

IMPROVE ONLINE PORTAL

To transfer codified, explicit knowledge, an improved online portal or intranet could be useful. The interface should be easy-to-use and the project related information should be easily found. Access to the online portal should be provided to all participants. The online portal would increase the diversity of communication channels but not substitute in-person communication.

ENABLE PARTICIPATION OF SMES AND ENSURE EVEN RESOURCE ALLOCATIONS

With regard to the low resource allocation, 0,5 annual working units should be avoided, as low resources tend to shape the research more straightforward and diminish the ratio between actual research work and administrative work. Furthermore, participation of small and medium-sized companies with reduced financial and resource investment contribution should be encouraged.

6 CONCLUSIONS

Due to the increased technology and market change companies and research organizations cooperate more and more outside organizational barriers. Rationale for collaboration is that potential innovations reside in the intersection of different bodies of knowledge and know-how. Furthermore, in order to survive in the global economy, one needs to collaborate to create breakthrough products and services. This study aimed at taking an in-depth look on one single case of a collaboration project in Finnish health and wellbeing cluster. It took a grass root level approach investigating the interaction and collaboration between individual participants in the project. Based on results from interview and observation data, several practical recommendations were proposed to support the project work during its existence. The ones that can be implemented in the formation phase of the project could be taken into consideration in future SHOK collaborations.

In line with the literature findings, several behavioural factors such as trust, motivation and communication were identified and considered important in the project (first research goal). Trust and getting to know to other participants formed the base of successful and interactive relationships. What might have lacked in the project was the amount of actual collaboration and interaction. Different locations of the participating companies and research organizations seemed to boost the independency of the research work. Furthermore, the individual mindset since the beginning of the project presumably lead to continuous individual work throughout the project. Barrier to contacting and meeting others was fairly high. In addition, IPR rules reduced the openness of communication and decreased the progress of the project.

Second goal of the research was to create several practical implications to support the project work. The activities were especially targeted to improve communication and interaction with relatively effortless implementation. Indeed, the project had much potential, as several structural factors e.g. financing, complementary expertise and project governance could be found in the project. The major challenge was to connect talented participants together. Indeed, in line with Liyanage, Greenfield and Don (1999), over the course of the research period, knowledge as a unit of analysis appeared to become increasingly important factor in the project.

Third research goal related to the future SHOK collaborations. Deriving from the results, SHOK activity was considered highly important in terms of financing instrument and collaboration means per se. Indeed, relevance for the national economy is in line with the SHOK report as it states that regional clusters are important to sustain national competitiveness of the economy (Lähteenmäki-Smith et al. 2013 p.307). The report further highlights the involvement of SMEs in SHOKs, which justifies the results of this study.

For future SHOK formations, the goals of the clusters including the benefits for the participating companies and research organizations should be more accurately articulated. Based on the results of this study, the benefits of the project were not clear although the importance of the project as a financing and research instrument was

highlighted, echoing the opinions of SHOK top management (Lukkari, 2013). The benefit of the SHOK projects should be clearly expressed i.e. what kind of activities did this type of collaboration enable. These benefits can range from new collaboration partners to tangible aspects such as innovative product concepts. Furthermore, the benefit as financing instrument should be considered: in order to create new products, other traditional financing models might be more suitable than SHOK-type open-ended models.

The project composition is not highly innovative, but one can consider the enhancing activities towards innovation and the origin of it. Eventually, do collaboration activities even need to be complicated or extraordinary? Putting together talented employees, enabling open communication, eliminating factors and barriers that limit the project progress and development might be sufficient. Rather managing the knowledge itself the collaboration "must manage the social environment in which motivated people are allowed to think and work together" (Rolland and Chauvel, 2000 p. 233).

Related to future ADF role, the practical activities suggested in this study could be tested and reviewed in other collaboration settings. Furthermore, the findings of this study indicate that using a facilitator or a knowledge broker such as ADF would prove to be worthwhile in complex projects. External facilitator would reduce the coordinator's workload as management tasks could be shared. Knowledge broker role would in addition prove to be effective in sharing best practices and workarounds between similar projects.

Theoretical contributions are somewhat limited as this study focused on one case with a practical approach to the project. The study emphasized the search for enhancing factors for and enablers to the collaboration between participants during the project. Due to the aim and nature of the study, it focused on understanding a single case rather than generalizing results and creating universal patterns to collaborative project work. Offering an in-depth understanding on one form of collaboration in a certain setting, the results of this study indicate that behavioural factors and relationships between individual participants play a major role in collaborations, and although considered obvious, facilitating interaction and information exchange has to be emphasized. What contradicts and requires more research is the influence of different working habits between academia and business. In addition, in order to create meaningful outcomes, the goals of the projects and the role of the companies should be clarified.

With regard to methodological examination, the study followed the principles of qualitative and case study research methods. As one project formed the boundaries of the study, the research data was gathered within a single case. To gather as rich and diverse data as possible, all initial participants of the project were intended to interview. However, as two of them were not reached, the emphasis on the reasons for withdrawing the project might not entirely be covered. Furthermore, in the interviewee sample, the ratio of representatives between companies and research organizations (two company and eight research organization representatives) was not even. In addition, one of the two company interviewees represented two work packages and naturally this person's answers contained information from both work packages indicating several possible differences and similarities between them.

However, the work packages and influencing factors cannot be directly compared to each other, as the settings in the two projects might be different. What furthermore could have added diversity to the case data would have been an interview with a company research representative. A company researcher was not interviewed due to time, resource and accessibility constraints.

This study revealed collaboration insights in a particular setting and opened up fruitful avenues for future research. What would be interesting to investigate is how the findings of this study could be either similar or different in other projects within the same industry cluster. Further construct could be to test the findings in other industry sectors. As Lähteenmäki-Smith et al. state, the organization model, catchphrases and key concepts are fairly similar in each of the SHOK strategies (2011, p. 47). Furthermore, a longitudinal study could be executed to investigate the influence of the proposed activities on the project performance and participants' perceptions of them. Indeed, this study focused on solution incubation, creating a foundation for a potential solution (Holmström, Ketokivi and Hameri, 2009). Proceeding to the next phase of the exploratory research would be solution refinement where the essence is in solution improvements and empirical testing in real context. On a broader scale, further research could be done on the transferability of the findings from this research to other types of strategic collaborations.

Furthermore, temporary mini-organization perspective creates interest to investigate the crucial procedures in setting up a project organization in more detail. Similarities and differences between static and temporary organization settings would be interesting to research in today's team- and project-based work. Team effectiveness literature especially in dispersed location context might provide more insight to the team performance. Finally, related to the future of SHOK collaborations, one could carefully consider the added value of and suitable indicators for measuring the progress.

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8 APPENDICES

APPENDIX 1: SUCCESS FACTORS OF STRATEGIC COLLABORATIONS

Codified factor:	**Success factor**	**Reference:**
Communication	Communications	Dodgson, 1993
Communication	Effective communication	Barnes, Pashby and Gibbons, 2006
Communication	Effective communication	Business-Higher Education Forum, 2003
Communication	Good communication	Mcnerney, 2009
Communication	Good communication	Kale, Singh and Perlmutter, 2000
Communication	Fast technology achievement reporting	Mcnerney, 2009
Communication	Information flow	Kanter, 1994
Communication	Making lessons learned anywhere in the alliance available across the alliance on a real time basis	Harbison, Pekar and Stasior, 1998 p. 92
Communication	Open communication to provide flexibility in resolving issues	Harbison, Pekar and Stasior, 1998 p. 92
Communication	Open frequent communication	Von Stamm, 2003
Complementarity	Equality of contribution	Barnes, Pashby and Gibbons, 2006
Complementarity	Equality of power/dependency	Barnes, Pashby and Gibbons, 2006
Complementary benefit	Value chain	Vyas, Shelburn and Rogers, 1995
Complementary benefit	Complementary assets	Ingham and Mothe, 1998
Complementary benefit	Interdependence	Kanter, 1994
Complementary benefit	Mutual benefit	Barnes, Pashby and Gibbons, 2006
Complementary expertise	Complementary expertise/strengths	Barnes, Pashby and Gibbons, 2006
Complementary expertise	Complementary expertise/strengths	Mowery, Oxley and Silverman, 1996
Complementary expertise	Complementary expertise/strengths	Harrigan, 1988
Complementary expertise	Complementarity/partner fit	Kale, Singh and Perlmutter, 2000
Complementary expertise	Complementary knowledge bases	Weck, 2006
Complementary expertise	Complementary expertise/strengths	Tucci and Cusumano, 1994
Flexibility	Barrier: failure to learn and understand cultural differences	Vyas, Shelburn and Rogers, 1995
Interaction	Facilitation of face-to-face meetings	Von Stamm, 2003

Learning	Accommodate learning	Laat and McKibbin, 2003
Learning	Learning	Büyüközkan and Arsenyan, 2012
Learning	Learning	Kale, Singh and Perlmutter, 2000
Learning	Learning capacity	Rolland and Chauvel, 2000
Management	Barrier: failure to understand new management style	Vyas, Shelburn and Rogers, 1995
Management	Clear roles and responsibilities	Barnes, Pashby and Gibbons, 2006 Weck, 2006
Management	Collaboration champion	Barnes, Pashby and Gibbons, 2006
Management	Dedicated collaboration space	Von Stamm, 2003
Management	Dedicated SA function	Dyer, Kale and Singh, 2001
Management	Defined project milestones	Barnes, Pashby and Gibbons, 2006
Management	Defining early the management roles	Harbison, Pekar and Stasior, 1998 p. 92
Management	Detailed timetables and measurement tools, with periodic review	Harbison, Pekar and Stasior, 1998 p. 92
Management	Effective coordination	Büyüközkan and Arsenyan, 2012
Management	Ensuring collaborators deliver	Barnes, Pashby and Gibbons, 2006
Management	Experienced and competent coordinator	Mcnerney, 2009
Management	Experienced project management	Weck, 2006
Management	Good project management	Mcnerney, 2009
Management	Integrated conflict management	Kale, Singh and Perlmutter, 2000
Management	Iterative solution development	Weck, 2006
Management	Provide managers the power needed to accomplish goals	Harbison, Pekar and Stasior, 1998 p. 92
Management	Regular progress monitoring	Barnes, Pashby and Gibbons, 2006
Management	Good project documentation and joint review	Weck, 2006
Management	Tracking competitors' reactions and tracking the progress itself	Harbison, Peka and Stasior 1998 p. 92
Motivation	Importance of the relationship	Porter and Fuller in Kanter 1994
Motivation	Interest and involvement	Laat and McKibbin, 2003
Motivation	Involvement/motivation Motivation	Ingham and Mothe, 1998
Motivation	Motivation	Mcnerney, 2009
Motivation	Motivation	Weck, 2006
Motivation	Lack of commitment to succeed	Vyas, Shelburn and Rogers, 1995
Partner fit	Corporate stability	Barnes, Pashby and Gibbons, 2006

Partner fit/Structure	Culture	Rolland and Chauvel, 2000
Partner fit/Structure	Integrated organizations	Kanter, 1994
Partner selection	Balancing contributions of partners	Vyas, Shelburn and Rogers, 1995
Partner selection	Experience in R&D	Ingham and Mothe, 1998
Partner selection	Partner selection	Dodgson, 1993
Partner selection	Synergy among partners	Vyas, Shelburn and Rogers, 1995
Resources	Adequate resources	Barnes, Pashby and Gibbons, 2006
Resources/Management	Human resources	Dodgson, 1993
Scope	Business viability	Weck, 2006
Scope	Clear customer need	Weck, 2006
Scope	Clearly defined objectives	Barnes, Pashby and Gibbons, 2006
Scope	Co-innovation	Büyüközkan and Arsenyan, 2012
Scope	Focused project scope	Weck, 2006
Scope	Relative scope/common/private scope	Khanna, Gulati and Nohria, 1998
Scope	Goal compatibility	Vyas, Shelburn and Rogers, 1995
Scope	Longer term investment	Kanter, 1994
Scope	Market need	Barnes, Pashby and Gibbons, 2006
Scope	Rationale for collaboration	Von Stamm, 2003
Scope	Realistic aims	Barnes, Pashby and Gibbons, 2006
Scope	Strategic intent	Rolland and Chauvel, 2000
Structure	Agreement on ownership of outcomes	Mcnerney, 2009
Structure	Basing alliance structure and processes on alliance strategy and requirements	Harbison, Pekar and Stasior, 1998 p. 92
Structure	Clear financial aspects	Laat and McKibbin, 2003
Structure	Flexible and adaptable structures	Dodgson, 1993
Structure	Form	Rolland and Chauvel, 2000
Structure	Institutionalization (support, legal docs, social ties, shared values)	Kanter, 1994
Structure	Mutually agreed workplan	Barnes, Pashby and Gibbons, 2006
Structure	No single format, customized approach	Laat and McKibbin, 2003
Structure	Simple collaboration agreement	Barnes, Pashby and Gibbons, 2006
Structure/Management	Flexible and lean organizational structure	Harbison, Pekar and Stasior, 1998 p. 92
Structure/management	Openness	Laat and McKibbin, 2003

Structure/Management	Transparency	Rolland and Chauvel, 2000
Trust	Trust	Hamel, 1991
Trust	Trust	Kale, Singh and Perlmutter, 2000
Trust	Trust	Dyer and Singh, 1998
Trust	Trust	Gulati, 1995
Trust	Trust	Büyüközkan and Arsenyan, 2012
Trust	Trust	Ingham and Mothe, 1998
Trust	Trust	Rolland and Chauvel, 2000
Trust	Trust	Dodgson, 1993